BID DOCUMENTS COVER SHEET

CONTRACT DOCUMENTS

FOR

D-4002 DVC San Ramon Campus

INCREMENT 2 –EXPANSION & RENOVATION

AT

DIABLO VALLEY COLLEGE
SAN RAMON CAMPUS
1690 Watermill Rd.
San Ramon, CA 94582

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

Consist of the following:
DSA Application #01-117630

Volume 1 of 2 - Divisions 0 & 1

Architect: Noll & Tam
729 Heinz Ave. #7
Berkeley, CA 94710
(510) 542-2200

May 30, 2019
Architect:
NOLL & TAM ARCHITECTS
729 Heinz Avenue
Berkeley, CA 94710

Christopher Noll
Number 15916
Expires 12/31/19

Civil:
BKF Engineers
1646 N. California Blvd., #400
Walnut Creek, CA 94596

Eric S. Swanson
Number 64607
Expires 06/30/19

Structural:
Walter P. Moore and Associates Inc.
596 Market Street, Suite 2130
San Francisco, CA 94105

William A. Andrews
Number 3773
Expires 03/31/20
Mechanical:
**Interface Engineering Inc.**
135 Main Street, Suite 400
San Francisco, CA 94105

Richard Russell
Number 31923
Expires 03/31/20

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Electrical:
**Interface Engineering Inc.**
135 Main Street, Suite 400
San Francisco, CA 94105

Jason Lau
Number 16806
Expires 09/30/20

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Plumbing:
**Interface Engineering Inc.**
135 Main Street, Suite 400
San Francisco, CA 94105

Richard Russell
Number 31923
Expires 03/31/20
Fire Protection:
**Interface Engineering Inc.**
135 Main Street, Suite 400
San Francisco, CA 94105

[Signature]

Richard Russell  
Number 31923  
Expires 03/31/20

Fire Alarm:
**Interface Engineering Inc.**
135 Main Street, Suite 400
San Francisco, CA 94105

[Signature]

Jason Lau  
Number 16806  
Expires 09/30/20

Telecom:
**Charles M. Salter and Associates**
130 Sutter Street, Floor 5
San Francisco, CA 94104

[Signature]

Kenneth Graven  
Number 15135  
Expires 06/30/20
Landscape:
**Merrill Morris Partners, Inc.**
249 Front Street
San Francisco, CA 94111

Signature ___________________________ Date _____________ Seal _____________

Dan Morris
Number 2533
Expires 04/30/20

END OF DOCUMENT
## List of Required Structural Tests & Special Inspections - 2016 CBC

**School Name:** Diablo Valley College - San Ramon Campus  
**District:** Contra Costa Community College District

**IMPORTANT:** This form is only a summary list of structural tests and some of the special inspections required for the project. Generally, the structural tests and special inspections noted on this form are those that will be performed by the Geotechnical Engineer of Record, Laboratory of Record, or Special Inspector. The actual complete test and inspection program must be performed as detailed on the DSA approved documents. The appendix at the bottom of this form identifies work NOT subject to DSA requirements for special inspection or structural testing. The project inspector is responsible for providing inspection of all facets of construction, including but not limited to, special inspections not listed on this form such as structural wood framing, high-load wood diaphragms, cold-formed steel framing, anchorage of non-structural components, etc., per Title 24, Part 2, Chapter 17A.

**NOTE:** This form is also available for projects submitted for review under the 2007, 2010, and 2013 CBC.

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### REQUIRED TEST OR SPECIAL INSPECTION

<table>
<thead>
<tr>
<th>TYPE</th>
<th>PERFORMED BY</th>
<th>CODE REFERENCE AND NOTES</th>
</tr>
</thead>
</table>

### SOILS

**1. GENERAL:**  
- X a. Verify that:  
  - Site has been prepared properly prior to placement of controlled fill and/or excavations for foundations,  
  - Foundation excavations are extended to proper depth and have reached proper material, and  
  - Materials below footings are adequate to achieve the design bearing capacity.
  
  Periodic  
  GE*  
  * By geotechnical engineer or his or her qualified representative. (See Appendix for exemptions.)

### COMPACTED FILLS:

- X a. Perform classification and testing of fill materials.  
  Test  
  LOR*  
  * Under the supervision of the geotechnical engineer.

- X b. Verify use of proper materials, densities and inspect lift thicknesses, placement, and compaction during placement of fill.  
  Continuous  
  GE*  
  * By geotechnical engineer or his or her qualified representative.

- X c. Test compaction of fill.  
  Test  
  LOR*  
  * Under the supervision of the geotechnical engineer.

### CONCRETE

**7. CAST IN PLACE CONCRETE**

**Material Verification and Testing:**

- X a. Verify use of required design mix.  
  Periodic  
  SI*  
  Table 1705A.3 Item 5, 1910A.1 (1909.2.3)*  
  * To be performed by qualified batch-plant inspector and concrete sampling technician

- X b. Identify, sample, and test reinforcing steel.  
  Test  
  LOR 1910A.2 (1909.2.4)*  
  ACI 318-14 Section 26.6.1.2, DSA IR 17-10.16

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**Note:** References are to the 2016 edition of the California Building Code (CBC) unless otherwise noted.

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**DSA-103**  
(Issued 9-1-17)  
+ In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that may be used by community colleges, per 2016 CBC Sec. 1.9.2.2.
<table>
<thead>
<tr>
<th>X</th>
<th>11. POST-INSTALLED ANCHORS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>a. Inspect installation of post-installed anchors</td>
</tr>
<tr>
<td>X</td>
<td>b. Test post-installed anchors.</td>
</tr>
</tbody>
</table>

**Inspection:**
- e. Batch plant inspection
  - Continuous
  - Periodic

See Notes SI

**Test LOR 1910A.5 (1909.2.7), (See Appendix for exemptions.)**

### 12. MASONRY

<table>
<thead>
<tr>
<th>X</th>
<th>- 13. STRUCTURAL MASONRY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>a. Mill certificate indicates compliance with requirements for reinforcement, anchors, ties, fasteners, and metal accessories. See item 7b above for identification, sampling, and testing of reinforcing steel.</td>
</tr>
<tr>
<td>X</td>
<td>b. Producer's certificate of compliance for masonry units, mortar and grout materials.</td>
</tr>
<tr>
<td>X</td>
<td>c. Test masonry ( f_{m}^{'} ).</td>
</tr>
<tr>
<td>X</td>
<td>d. Verify proportions of site-prepared, premixed or preblended mortar and grout.</td>
</tr>
<tr>
<td>X</td>
<td>e. Test core-drilled samples.</td>
</tr>
<tr>
<td>X</td>
<td>g. Verify size, location and condition of all dowels, construction supporting masonry, etc.</td>
</tr>
<tr>
<td>X</td>
<td>h. Verify size, grade, and type of reinforcement and anchor bolts.</td>
</tr>
<tr>
<td>X</td>
<td>i. Inspect placement of reinforcement and connectors.</td>
</tr>
<tr>
<td>X</td>
<td>j. Inspect placement of masonry units and construction of mortar joints.</td>
</tr>
<tr>
<td>X</td>
<td>l. Verify preparation, construction, and protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90°).</td>
</tr>
<tr>
<td>X</td>
<td>m. Inspect type, size, and location of anchors and all other items to be embedded in masonry including other details of anchorage of masonry to structural members, frames and other construction.</td>
</tr>
<tr>
<td>X</td>
<td>n. Inspect grout space prior to grouting and placement of grout.</td>
</tr>
</tbody>
</table>

**Material Verification and testing:**
- Enter \( f_{m}^{'} \) 1900 psi
- Periodic SI
- **Test LOR 2105A.4 (2103.4**.
- **Test LOR 1905A.1.16** (1909.3.7); ACI 318-14 Section 26.12.

**Periodic SI:**
- **Test LOR 1705A.4**
- **Test LOR 1705A.3 Item 4a (Continuous) & 4b (Periodic) (see Appendix for exemptions). ACI 318-14 Sections 17.8 & 26.13**
- **Test LOR 2105A.2, 2105A.3 (2114.6.1**.
- **Test LOR 1905A.1.4.2, 1.4B.3, 1.4B.4, 1.5B.1 & 1.5B.2**. For Prism (required when \( f_{m}^{'} > 2000 \text{ psi} \)): **2105A.3 (2114.6.1**.
- **Test LOR 2105A.3 Item 2a, TMS 602-13 Table 5 Item 2a.**
- **Test LOR 2105A.4 (2114.6.2**.

**Inspection:**
- **Test LOR 1905A.1.16 (1909.3.7); ACI 318-14 Section 26.12.**
- **2105A.3 Item 6, ACI 318-14 Sections 26.5 & 26.12**
- **May be performed by the project inspector when specifically approved by DSA.**

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**Notes:**
- **Continuous** per **1705A.3.3.** If approved by DSA, batch plant inspection may be reduced to **Periodic** subject to requirements in **Section 1705A.3.3.1** or eliminated per **1705A.3.3.2.** (See Appendix for exemptions.)
- **To be performed by qualified LOR representative. Applicable testing by LOR. See IR 17-10.16 for unidentified reinforcing steel.**
- **May be performed by the project inspector when specifically approved by DSA.**
- **May be performed by the project inspector when specifically approved by DSA.**
- **May be performed by the project inspector when specifically approved by DSA.**
- **May be performed by the project inspector when specifically approved by DSA.**

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**Additional Notes:**
- **In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that may be used by community colleges, per 2016 CBC Sec. 1.9.2.2.**
14. VENEER OR GLASS BLOCK PARTITIONS: 1705A.4.1, TMS 402-13 Table 3.1.2, TMS 602-13 Table 4

- a. Verify proportions of site-prepared mortar and grout and/or verify certification of premixed mortar.  
  Periodic SI  TMS 402-13 Table 3.1.2 Item 2a & 3d, TMS 602-13 Table 4 Item 2a & 3d.

- b. Inspect placement of units and construction of mortar joints.  
  Periodic SI  TMS 402-13 Table 3.1.2 Item 2b & 3e, TMS 602-13 Table 4 Item 2b & 3e.

- c. Inspect placement of reinforcement, connectors and anchors.  
  Periodic SI  TMS 402-13 Table 3.1.2 Item 3c, TMS 602-13 Table 4 Item 3c.

- d. Inspect type, size, and location of anchors and all other items to be embedded in masonry including details of anchorage of masonry to structural members, frames and other construction.  
  Periodic SI  TMS 402-13 Table 3.1.2 Item 2d, 3b & 4b, TMS 602-13 Table 4 Item 2d, 3b & 4b.

- e. Inspect preparation, construction, and protection of masonry during cold weather (temperature below 40°F) or hot weather (above 90°F).  
  Periodic SI*  TMS 402-13 Table 3.1.2 Item 4d, TMS 602-13 Table 4 Item 4d. * May be performed by the project inspector when specifically approved by DSA.

17. STRUCTURAL STEEL, COLD-FORMED STEEL, AND ALUMINUM USED FOR STRUCTURAL PURPOSES

Material Verification:

- a. Verify identification of all materials and:  
  • Mill certificates indicate material properties that comply with requirements,  
  • Material sizes, types and grades comply with requirements.  
  Periodic *  2203A.1 (2203.1*), Table 1705A.2.1 Item 3a-3c; AISI S100-07/S2-10 Section A2.1 & A2.2, AISI S200-12 Section A3, AISI S220-11 Section A4. * By special inspector or qualified technician when performed off-site.

- b. Test unidentified materials  
  Test LOR  2203A.1 (2203.1*).

- c. Examine seam welds of HSS shapes  
  Periodic SI  DSA IR 17.3.

Inspection:

- d. Verify and document steel fabrication per DSA approved construction documents.  
  Periodic SI  Not applicable to cold-formed steel light-frame construction, except for trusses (1705A.2.4).

19. WELDING:

Verification of Materials, Equipment, Welders, etc:

- a. Verify weld filler material identification markings per AWS designation listed on the DSA approved documents and the WPS.  
  Periodic SI  DSA IR 17.3.

- b. Verify weld filler material manufacturer’s certificate of compliance.  
  Periodic SI  DSA IR 17.3.

- c. Verify WPS, welder qualifications and equipment.  
  Periodic SI  DSA IR 17.3.

19.1 SHOP WELDING:

- a. Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds  
  Continuous SI  Table 1705A.2.1 Item 5a-1.4. Per AISC 360-10 (and AISC 341-10 as applicable). DSA IR 17-3.

- b. Inspect single-pass fillet welds ≤ 5/16”, floor and roof deck welds  
  Periodic SI  1705A.2.2, Table 1705A.2.1 Item 5a.5 & 5a.6. Per AISC 360-10 (and AISC 341-10 as applicable). DSA IR 17-3.

19.2 FIELD WELDING:

- a. Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds  
  Continuous SI  Table 1705A.2.1 Item 5a-1.4. Per AISC 360-10 (and AISC 341-10 as applicable). DSA IR 17-3.

- b. Inspect single-pass fillet welds ≤ 5/16”  
  Periodic SI  Table 1705A.2.1 Item 5a.5. Per AISC 360-10 (and AISC 341-10 as applicable). DSA IR 17-3.

- c. Inspect end-welded studs (ASTM A-108) installation (including bend test)  
  Periodic SI  2213A.2 (2212.6.2*); per AISC 360-10 (and AISC 341-10 as applicable), AWS D1.1. DSA IR 17-3.
<table>
<thead>
<tr>
<th></th>
<th>23. ANCHOR BOLTS, ANCHOR RODS, &amp; OTHER STEEL:</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>a. Anchor Bolts and Anchor Rods</td>
</tr>
<tr>
<td></td>
<td>Test LOR</td>
</tr>
<tr>
<td></td>
<td>IR 17-11 Sample and test anchor bolts and anchor rods not readily identifiable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>24. PREFABRICATED WOOD STRUCTURAL ELEMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>a. Inspect fabrication of structural glued-laminated timber.*</td>
</tr>
<tr>
<td></td>
<td>Continuous SI</td>
</tr>
<tr>
<td></td>
<td>§ See 1705A.5.4 for exceptions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>25. OTHER WOOD:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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* See 1705A.5.4 for exceptions
List of required verified report(s):

1. **Soils testing and Inspection**: Geotechnical Verified Report - Form DSA-293
2. **All Structural Testing**: Laboratory Verified Report - Form DSA-291
3. **Concrete Batch Plant Inspection**: Laboratory Verified Report - Form DSA-291
4. **Masonry Inspection**: Laboratory Verified Report - Form DSA-291, or, for independently contracting SI, Special Inspection Verified Report - Form DSA-292
5. **Shop Welding Inspection**: Laboratory Verified Report - Form DSA-291, or, for independently contracting SI, Special Inspection Verified Report - Form DSA-292
6. **Field Welding Inspection**: Laboratory Verified Report - Form DSA-291, or, for independently contracting SI, Special Inspection Verified Report - Form DSA-292
7. **Glu-Lam Wood Fabrication Inspection**: Laboratory Verified Report - Form DSA-291, or, for independently contracting SI, Special Inspection Verified Report - Form DSA-292

**KEY to Columns**

<table>
<thead>
<tr>
<th>1 Type -</th>
<th>2 Performed By -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous – Indicates that a continuous special inspection is required</td>
<td>GE – Indicates that the special inspection is to be performed by a registered geotechnical engineer or his or her authorized representative</td>
</tr>
<tr>
<td>Periodic – Indicates that a periodic special inspection is required</td>
<td>LOR – Indicates that the test or inspection is to be performed by a testing laboratory accepted in the DSA Laboratory Evaluation and Acceptance (LEA) Program. See section 4-335, 2013 CCR Title 24, Part 1.</td>
</tr>
<tr>
<td>Test – Indicates that a test is required</td>
<td>SI – Indicates that the special inspection is to be performed by a special inspector</td>
</tr>
</tbody>
</table>

**Name of Architect or Engineer in general responsible charge**

William A. Andrews, SE

**Name of Structural Engineer (When structural design has been delegated)**

William A. Andrews, SE

Signature of Architect or Structural Engineer

06-14-2019

**Identification Stamp**

DIV OF THE STATE ARCHITECT

APP. # 01-117630

AC N/A F/LS N/A SS

DATE

**Approved**

DIV. OF THE STATE ARCHITECT

APP. 01-117630 INC:02

Reviewed for

SS ☑ FLS ☑ ACS ☑

DATE: 06/14/2019

*In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that may be used by community colleges, per 2016 CBC Sec. 1.9.2.2.*
Appendix: Work Exempt from DSA Requirements for Special Inspection or Structural Testing

Exempt items given in IR A-22 or the 2016 CBC (including DSA amendments) and those items identified below with an "X" by the design professional are NOT subject to DSA requirements for the structural tests or special inspections noted. Items marked as exempt shall be identified by either: 1) listing specific details/sheets noted in the spaces provided below OR 2) on the approved construction documents. The project inspector shall verify all construction complies with the approved construction documents.

<table>
<thead>
<tr>
<th>Exempted by Design Prof:</th>
<th>Exempted by Design Prof:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soils:</td>
<td>Welding:</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>1. Deep foundations acting as a cantilever footing designed based on minimum allowable pressures per 2016 CBC Table 1806A.2 and having no geotechnical report for the following types of structures: free standing sign, scrolling message sign, scoreboard, covered walkway or shade structure with dead load less than 5 psf and other light-weight structures of which the apex is less than 8' above the highest adjacent grade.</td>
<td>1. Solid-clad and open-panel gates with maximum leaf span or rolling section for rolling gates of 10' and apex height less than 8'-0&quot; above lowest adjacent grade. When located above circulation or occupied space below, these gates are not located within 1.5x gate/fence height (max 8'-0&quot;) to the edge of floor or roof.</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Shallow foundations meeting the exception item #1 criteria specified in 2016 CBC Section 1803A.2.</td>
<td>2. Handrails, guardrails, and modular or relocatable ramps associated with walking surfaces less than 30&quot; above adjacent grade (excluding post base connections per the 'Exception' language in Section 1705A.2.1); fillet welds cannot be ground flush.</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>3. Non-structural interior cold-formed steel framing spanning less than 15'-0&quot;, such as in interior partitions, interior soffits, etc. supporting only self weight and light-weight finishes or adhered tile, masonry, stone, or terra cotta veneer no more than 5/8&quot; thickness and apex less than 20'-0&quot; in height and not over an exit way. Maximum tributary load to a member shall not exceed the equivalent of that occurring from a 10'x10' opening in a 15' tall wall for a header or king stud.</td>
</tr>
<tr>
<td>Concrete/Masonry:</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>4. Manufactured support frames and curbs using hot rolled or cold-formed steel (i.e., light gauge) for mechanical, electrical, or plumbing equipment weighing less than 2000# (equipment only) (connections of such frames to structure elements using welding will require special inspection as noted in selected item(s) for section 19, 19.1 and/or 19.2 of listing above).</td>
</tr>
<tr>
<td>1. Post-installed anchors for the following: 1) exempt non-structural components (e.g., mechanical, electrical, plumbing equipment - see item 7 for &quot;Welding&quot;) given in CBC Section 1616A.1.18 (which replaces ASCE 7-10, Section 13.1.4) or 2) interior nonstructural wall partitions meeting criteria listed in exempt item 3 for &quot;Welding.&quot;</td>
<td>X</td>
</tr>
<tr>
<td>2. Concrete batch plant inspection is not required for items given in CBC Section 1705A.3.3.2 subject to the requirements and limitations in that section.</td>
<td>5. Manufactured components (e.g., Tolco, B-Line, Alcon, etc.) for mechanical, electrical, or plumbing hanger support and bracing (connections of such components to structure elements using welding will require special inspection as noted in selected item(s) for section 19, 19.1 and/or 19.2 of listing above).</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>6. TV Brackets, projector mounts with a valid listing (see DSA IR A-5) and recreational equipment (e.g., playground structures, basketball backstops, etc.) (connections of such elements to superstructure elements using welding will require special inspection as noted in selected item(s) for section 19, 19.1 and/or 19.2 of listing above).</td>
</tr>
</tbody>
</table>

+ In the CODE REFERENCE AND NOTES column indicates DSA-SS/CC sections that may be used by community colleges, per 2016 CBC Sec. 1.9.2.2.
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Masonry retaining walls less than 4’-0” above the top of foundation not supporting a surcharge and free standing nonbearing non-shear masonry walls up to 6’-0” above adjacent grade do not require grout, mortar or masonry core testing or DSA special inspection.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Epoxy shear dowels in site flatwork.</td>
<td>(Optional) List details for applicable exempt items:</td>
</tr>
<tr>
<td>7.</td>
<td>Any support for exempt non-structural components given in CBC Section 1616A.1.18 (which replaces ASCE 7-10, Section 13.1.4) meeting the following: 1) when supported on a floor/roof, &lt;400# and resulting composite center of mass (including component’s center of mass) &lt;= 4’ above supporting floor/roof, 2) when hung from a wall or roof/floor, &lt;20# for discrete units or &lt;5 plf for distributed systems.</td>
<td>(Optional) List details for applicable exempt items:</td>
</tr>
</tbody>
</table>
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**VOLUME 01 – DIVISIONS 00-01**

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**DIVISION 01  PROJECT REQUIREMENTS**

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NOTICE INVITING BIDS

D-4002 San Ramon Campus Increment 2 – Expansion & Renovation
Diablo Valley College San Ramon Campus
1690 Watermill Road, San Ramon, CA 94582

NOTICE IS HEREBY GIVEN that the Governing Board of the Contra Costa Community College District (District), Martinez, California, will receive sealed bid proposals for the furnishing of all labor, materials, equipment, transportation and services for the construction of the project entitled D-4002 San Ramon Campus Increment 2 – Expansion and Renovation.

Construction Cost Estimate (Range): $8,000,000.00 to $10,000,000.00
California License Required: B - General Building Contractor

The Overall Project Summary consists of renovations to portions of the existing instructional buildings as well as the construction of a new 6600 SF Library and Learning Resource Center and site improvements. The Invitation to bid specifically addresses the scope related to Increment 2, Renovation.

Increment 2 Work includes, but is not limited to:
1. Renovations at the Learning Commons
2. Renovations at the existing West Building for a new Café, including site improvements for a grease interceptor and trash/recycle/compost enclosure
3. Accessibility upgrades to existing restrooms as needed
5. Site Improvement at the new LLRC, including subgrade preparations, rerouting of existing underground utilities, extension of utilities to serve the new buildings and landscape improvements

The District does not provide hardcopies of bid documents or reimburse cost of printing, delivery, or any expenses related to the bidding process.

For information directly from the District, you may also log on to the District Website: http://www.4cd.edu/webapps/PurchasingViewBids/default.aspx. Project documents available include, but are not limited to, plans, specifications, addenda, bidders lists, bid results, etc., and can be viewed on this District webpage. Builders Exchanges around Northern California are also notified.

This project is subject to the terms and conditions of a Project Stabilization Agreement (PSA) executed between the Contra Costa Community College District and the Contra Costa County Building & Construction Trades Council ("Council") and its affiliated local signatory unions.

All questions related to this project must be in writing and are directed to:
Ben M. Cayabyab, Contracts Manager (Interim)
Contra Costa Community College District
500 Court St., Martinez, CA 94553
Email: bcayabyab@4cd.edu

Each bid shall be made on the bid form, which is included in the Bid Documents and when submitted, shall be accompanied by a Bid Bond or Certified Cashier’s Check in the amount of 10% of bid (made payable to
the Contra Costa Community College District). The District reserves the right to forfeit Bid Bond submitted for failure of the successful bidder to secure Payment & Performance Bonds.

IMPORTANT INFORMATION:

Pre-Bid Meeting and Job Walk, Date / Time: July 25, 2019, 9:00 AM (Mandatory)
Pre-Bid Meeting and Job Walk, Location: Diablo Valley College, San Ramon Campus
1690 Watermill Road
San Ramon, CA 94582
Meet at Center Fountain in Plaza

Last Date / Time for
Bidder’s Requests for Information: August 5, 2019 at 5:00PM
Last Day/Time to Issue Addendum: August 12, 2019 at 5:00PM
Bids Due No Later Than, Date / Time: August 19, 2019 at 2:00PM

Bids Must Be Received at:
Contra Costa Community College District (Lobby)
500 Court St, Martinez, CA 94553
Attn: Ben Cayabyab – Contracts Manager (CCCD)

Bids must be received by the District prior to the time and by the date noted above. Bids that are not received by the District prior to the time and by the date noted above will not be accepted, and will be returned to the Bidder unopened.

The successful bidder will be required to furnish a labor and material bond in an amount equal to one hundred percent (100%) of the contract price and a faithful performance bond in an amount equal to one hundred percent (100%) of the contract price, said bonds to be secured from a surety company acceptable to the Contra Costa Community College District and authorized to execute such surety in the State of California.

This project is a public works project and is subject to prevailing wage rate laws. A copy of the prevailing rates of wages is on file with the Contracts & Purchasing Office of the Contra Costa Community College District. Said rates of wages shall be included in the contract for the work by this reference.

Attention is directed to Section 4100 through 4113 of the Public Contract Code concerning Subcontractors, with emphasis on Section 4104, known as the “Subletting and Subcontracting Fair Practices Act, effective July 1, 2014.

Attention is directed to Labor Code Section 1725.5 regarding Department of Industrial Relations (DIR) contractor registration process including registration criteria and implementation of DIR registration requirements. Labor Code Section 1771.7 establishes contractor’s obligation to submit Certified Pay Roll (CPR) to the Department of Labor and Standards Enforcement (DLSE) and public works monitoring and enforcement. Labor Code Section 1773.3 requires the District to submit a PWC-100 to DIR for all public works contract awarded effective January 1, 2015.

Attention is directed to Section 00600, Construction Agreement, Article 5, and Section 00700 GENERAL CONDITIONS, Article 8, paragraphs 8.4.1 and 8.4.2, regarding liquidated damages. Liquidated Damages shall be set for $1,000 Dollars for each calendar day the work is delayed beyond the Contract Substantial Completion date. The Governing Board of the Contra Costa Community College District reserves the right to reject any and all bids and/or waive any informality or irregularity in any bid received. No bidder may withdraw their Bid for a period of ninety (90) days after the date set for opening thereof.

END OF SECTION 00100
SECTION 00200
INSTRUCTIONS TO BIDDERS

1.1 ISSUING OF DOCUMENTS
A. Bidding Documents may be examined at the Contra Costa Community College District, 500 Court Street, Martinez, CA 94553. By Appointment: Georgette Stewart, Facilities Department, phone: (925)229-6847.

1.2 QUALIFICATIONS OF BIDDERS
A. Bidders may be required to furnish evidence satisfactory to the District and the Architect that he has sufficient means and has had sufficient experience in the class of work called for to enable him to complete the Contract in a satisfactory manner.
B. Bidders shall be Contractors properly licensed in accordance with the laws of the State of California.
C. The successful Bidder shall furnish satisfactory Certificates of Insurance coverage as specified in the Contract Documents.

1.3 RECEIPT AND OPENING OF BIDS
A. Contra Costa Community College District hereinafter referred to as the District, will receive Bids at the same time and place specified in the Notice inviting Bids.
B. Complete the Bid Form included in the Project Manual.
C. The envelopes containing the Bids shall be sealed, addressed to the District, and designated as “D-4002 DVC San Ramon Campus Increment 2 Expansion and Renovation Project - Contra Costa Community College District”. The envelope shall contain the name and address of the Bidder.
D. Bids that are mailed shall have the previously described envelope placed inside an envelope addressed to: CONTRA COSTA COMMUNITY COLLEGE DISTRICT, 500 Court Street, Martinez, CA 94553 ATTENTION: Ben Cayabyab, Contracts Manager. Bids should be mailed in time to be received prior to the time set forth in the Advertisement for Bids.
E. Bids which are conditional (or which make alterations, omissions, or reservations to the terms of the Bidding Documents) may be rejected as non-responsive.
F. All monetary figures are required, both in writing and in numerals. In event of conflict between written quotations and numerical quotations, written quotations shall govern.
G. Type or print all bid data legibly in ink except signatures which shall be in script. Mistakes may be crossed out and corrections inserted, if each is initialed in ink by signer of Bid.
H. Bidder’s business address and signature shall be on the Bid. A Bid by a partnership shall furnish the full names of partners and be signed in the partnership name by one member of the partnership, or by authorized representative, followed by the signature and designation of the person signing. Bids by corporations, with corporate seal affixed, shall be signed with the legal
name of the corporation followed by the name of the state of incorporation and by the
signature and designation of the person authorized to bind it to the matter. The name of each
person signing shall also be typed or printed below the respective signatures. When required
by the District, satisfactory evidence of authority of the office signing in behalf of the
corporation shall be furnished.

I. No Bids will be received after the date and time set forth in the Notice Inviting Bids.

1.4 BID SECURITY

A. Submit with the Bid a Bid Security in the amount of 10 percent (10%) of the Bid.

B. The District reserves the right to forfeit the Bid Bond submitted for failure of the successful
bidder to secure Payment & Performance Bonds.

1.5 SURETY BONDS

A. The successful Bidder shall furnish a Labor and Material Payment Bond in the amount equal to
one hundred percent (100%) of the Contract Price and a faithful Performance Bond in the
amount equal to 100 percent (100%) of the Contract Price as security for the successful
performance of the work and payment of persons performing labor and furnishing materials.
The Bonds shall be executed by a surety company or companies acceptable to the District and
authorized to execute such in the State in which the Project is located and shall be furnished
within 10 days after Notice of Acceptance of said Bid. Surety shall be made in favor of the
District and shall cover the guarantee periods as well as the construction period.

1.6 WITHDRAWAL OR REVISIONS OF BID

A. This Bid may be withdrawn or revised prior to the scheduled time for receipt. Bids not
withdrawn prior to the scheduled time for receipt may not be withdrawn for a period of 90
days.

1.7 BID PROTESTS

A. Inquiries or questions based on alleged patent ambiguity of the plans, specifications or
estimate must be communicated as a bidder inquiry prior to bid opening. Any such inquiries
or questions, submitted after bid opening, will not be treated as a bid protest.

B. Bidder may file a protest with the District against the Bid of other Bidder or Bidders (“Bid
Protest”) subject to the provisions of this Article. The procedures and time limits set forth in
this Article are mandatory and are a Bidder’s sole and exclusive remedy in protesting other
Bidders’ bids. Failure to comply with these procedures shall constitute a waiver of any right to
pursue a Bid Protest, or to contest the District’s award of the contract for the work that is the
subject of the Bid, in any legal proceeding before any authority with jurisdiction.

C. Bid Protests and Responses shall be governed by the following time limitations:

1. Bidder must deliver any Bid Protest to the District in writing before: 2:00PM five (5)
working days after the date of bid opening. The District will reject any Bid Protest not
received by the District by this deadline. Bidder must concurrently deliver a copy of its Bid
Protest to all Bidders against whose Bids the Bid Protest is directed. The Bidder must
include with its Bid Protest written proof to the District’s satisfaction that Bidder has
 delivered a copy of its Bid Protest to the other Bidder whose bid is the subject of the Bid Protest.

2. A Bidder whose Bid is the subject of a Bid Protest must deliver its written response, if any, (“Response”) to the District, before: 2:00PM ten (10) working days after the date of bid opening. The District will reject any Response not received by the District by this deadline.

D. Delivery of Bid Protest or Response:
1. Bidder may deliver a Bid Protest to the District by personal delivery or electronic transmission such as by facsimile. Bidder is solely responsible for ensuring that the District receives any Bid Protest or Response by the deadlines set forth herein.

2. The District will not consider Bid Protests or Responses by telephone conversation or any other non-written communication.

3. Bidder shall submit any Bid Protest or Response to:
   David Wetmore
   Director of Purchasing & Contracts
   Contra Costa Community College District
   500 Court Street, Martinez, CA. 94553
   dwetmore@4cd.edu
   925-370-7512 (fax)

E. Content of Bid Protest:
1. A Bid Protest must state the basis for the protest and provide supporting evidence.

2. A Bid Protest must refer to the specific portion of the Bid that forms the basis of the protest.

3. A Bid Protest must include the name, address, and telephone number of the person representing the protesting Bidder.

4. A Bid Protest must be clearly identified as a Bid Protest.

1.8 AWARD AND REJECTION OF BIDS

A. In awarding or rejecting Bids, the District reserves the following rights:
1. Identification of successful Bidder will not be determined at time of opening Bids.

2. To obtain opinion of counsel on legality and sufficiency of bids.

3. To reject all Bids, to re-bid, or waive irregularities or informalities in a Bid, and to accept or reject alternates.

4. Request proof that the successful Bidder can provide performance and payment bonds as required.

1.9 EXAMINE DOCUMENTS AND VISIT SITE

A. Before submitting a Bid, the Bidder shall examine the Bidding Documents, visit the site of the work, attend the required site visit arranged by the District and obtain Certification of Attendance signed by the District, ascertain existing conditions and limitations, including those of labor, and include in the Bid a sum to cover the cost of all items described in the Contract Documents.
B. No consideration will be granted for alleged misunderstanding of the materials to be furnished or work to be done. The tender of a Bid carries with it the agreement to terms and conditions referred to in the Contract Documents.

1.10 DISCREPANCIES, AMBIGUITIES, OR CONFLICTS

A. If the Bidder is in doubt as to the true meaning of any part of the Contract Documents; finds discrepancies, errors or omissions therein; or finds variances in any of the Contract Documents with applicable rules, regulations, ordinances and/or laws, a written request for an interpretation or correction thereof must be submitted to the District’s Contract Manager. Bidders are solely responsible for submitting to District’s Contract Manager such request. Ambiguities or inconsistencies arising as a result of separation of sections or portions of the drawings or specifications by or for subcontractor bidding shall not relieve the Contractor for providing the complete Work without increase to or adjustment in the Contract Price or the Time for performance. Interpretations or corrections of the Contract Documents will be by written addendum issued by the Architect. No person is authorized to render an oral interpretation or correction of any portion of the Contract Documents to any Bidder, and no Bidder is authorized to rely on any such oral interpretation or correction. Failure to request interpretation or clarification of any portion of the Contract Documents pursuant to the foregoing is a waiver of any discrepancy, defect or conflict therein.

1.11 ADDENDA

A. Cost for work included in any Addenda issued during the time of bidding shall be included in the Bid, and will become a part of the Contract. List Addenda received as indicated on the Bid Form.

1.12 FORM OF AGREEMENT

A. The form of agreement to be used for the Contract is provided by the District and is included in the Project Manual.

1.13 AWARD OF CONTRACT

A. The District will be allowed a period of ninety (90) days after Bid Opening Date for evaluating the Bids.

B. Bidders of record will be notified of the results of the District’s evaluation of bids and Award of Contract, if any.

C. The contractor shall begin work within ten (10) calendar days of receipt of Notice to Proceed.

END OF SECTION 00200
SECTION 00210
INFORMATION AVAILABLE TO BIDDERS

PART 1 - REPORT AND INFORMATION

1.1 Existence of reports, record drawings, and utility surveys: Contra Costa Community College District, its consultants, and prior contractors may have collected documents providing a general description of the site and conditions of the work. These documents may consist of geotechnical reports for and around the site, record drawings, utility drawings, and information regarding underground utilities. These reports, documents and other information are not part of the Contract Documents and do not show new work to be constructed, rather, they show existing conditions that Contractor may have to address as part of its construction planning.

1.2 Available Documentation: The following documents are either available for review through District office, or the District’s web site:

A. Campus As-Built Drawings, Dated 03/2007 as available
B. Campus Underground Utility Survey

1.3 Contractor shall acknowledge and accept that the documents are not a part of the Contract Documents and are made available to bidders for reference only. The District and its representatives are not responsible for any and all discrepancies between the documents and the existing and actual as-built conditions, and do not guarantee the accuracy of the documents.

1.4 The District and Architect assume no responsibility for the completeness or accuracy of the documents, or the records compiled there from and the interpretations made from the documents. There is no express or implied guarantee that the conditions indicated in the documents are representative of those existing throughout the building and/or site Conditions differing substantially from those indicated may be encountered.

END OF SECTION 00210
SECTION 00300
BID PROPOSAL FORM

PROJECT NUMBER / NAME: D-4002 San Ramon Campus Increment 2 Expansion and Renovation

CAMPUS / LOCATION: Diablo Valley College San Ramon Campus,
1690 Watermill Road, San Ramon, CA 94582

DISTRICT: CONTRA COSTA COMMUNITY COLLEGE DISTRICT
500 Court St, Martinez, CA 94553

Herein Referred to as "District"

1. INTRODUCTION

   A. The Bidder proposes to perform the Work for the Contract Sum and within the proposed Contract Time, based upon an examination of the site and the Bid and Contract Documents.

   B. The Bidder certifies this Bid is submitted in good faith.

   C. The Bidder agrees that the Contract Sum and other proposed terms will be considered in evaluating Bids and may be negotiated and adjusted before awarding of Contract.

   D. The signed copy of the Certification of the Visit to the Site shall be attached to the Bid Form Submittal.

   E. A fully executed Statement of Bidder's Qualifications signed by an authorized officer of the Bidder submitting the Bid shall be attached to the Bid Form.

   F. A fully executed Non-Collusion Affidavit signed by an authorized officer of the Bidder submitting Bid shall be attached to the Bid Form.

   G. The lowest responsive and responsible bidder will be determined based on the total of Base Bid plus any Additive Alternates at the District’s sole discretion.

   H. The District reserves the right to award the other Additive Alternates through change orders as budget allows.

2. CONTRACT SUM

   A. BASE BID: D-4002 San Ramon Campus Increment 2 Expansion and Renovation

   For labor, materials, bonds, fixtures, equipment, tools, transportation, services, sales taxes and other costs necessary to complete the general construction in accordance with the Contract Documents, for a stipulated Contract Sum in the amount of:
Provide cost per lineal foot for cement plaster control joints:

____________________________________________ Dollars ($______________________)

B. ADDITIVE ALTERNATES

ADD ALTERNATE 1. ROUND STONE FOUNTAIN BETWEEN LIBRARY RESOURCE CENTER AND EXISTING EAST BUILDING -INFRASTRUCTURE TO FOUNTAIN TO BE PART OF BASE BID:

____________________________________________ Dollars ($______________________)

TOTAL BASE BID PLUS ALTERNATES:

_____________________________________________ DOLLARS ($______________________)

3. COMPLETION TIME

A. For establishing the Date of Substantial Completion, the contract time for the Base Bids and Alternates selected shall be **425 calendar days** after date of the Notice To Proceed. This time may be subject to modification to facilitate the work as mutually agreed upon at a later date.

B. The Bidder certifies that the Bid is based on the Contract Time for completion as stated above and in the Contract Documents. Bidder further certifies that the Base Bid (plus alternates if selected) amount is sufficient to cover all labor, materials, central office and construction site overhead, profit, and all other costs related to the completion of the Project for the entire Project construction time for both the General Contractor and all Subcontractors, as stated above in paragraphs 2 and 3.

4. ADDENDA

A. The Bidder acknowledges receipt of the following Addenda and certifies the Bid has provided for all modifications and considerations required therein.

None [ ]

Addendum No.: ________ dated ________________

Addendum No.: ________ dated ________________

Addendum No.: ________ dated ________________

Addendum No.: ________ dated ________________
B. List of Additional Addenda Attached: Yes [    ] No [    ].

5. DESIGNATION OF SUBCONTRACTORS

A. The Bidder has set forth a complete list indicating the type of work, name, and business address of each Subcontractor who will perform work in excess of one-half of one percent of the Contract Sum.

B. Any portion of the work in excess of the specified amount having no designated Subcontractor shall be performed by the Bidder.

C. Substitution of listed Subcontractors will not be permitted unless approved in advance by the District.

D. Prior to signing the Contract, the District reserves the right to reject any listed Subcontractor.

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<thead>
<tr>
<th>Type of Work</th>
<th>Subcontractor’s Name</th>
<th>Business Address</th>
<th>License #</th>
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E. Complete list of Subcontractors is attached: Yes [    ] No [    ]
F. Continuation list of Subcontractors is attached: Yes [    ] No [    ]

6. ACCEPTANCE AND AWARD

A. The District reserves the right to reject this Bid and to negotiate changes before or after execution of the Contract. This Bid shall remain open and shall not be withdrawn for a period of 90 days after Bid Opening date.

B. If written notice of acceptance of this Bid is mailed or delivered to the Bidder within 90 days after the date set for the receipt of this Bid, or other time before it is withdrawn, the Bidder will execute and deliver to the District a Contract prepared by District with the required Surety Bonds and Certificates of Insurance, within 10 days after personal delivery or deposit in the mail of the notification of acceptance.

C. Notice of acceptance or request for additional information may be addressed to the Bidder at the address provided.
7. **BID SECURITY**

   A. The required 10 percent (10%) Bid Security for this Bid is attached in the form of:

   ( ) Bid Bond Issued By: ________________________________

   ( ) Certified or Cashier's Check No.________________________

   Issued by: ____________________________________________

8. **BIDDER'S BUSINESS INFORMATION**

   A. **Individual [ ]**: Personal Name: ____________________________  
      Business Name: ____________________________________________  
      Address: ___________________________________________________  
      ____________________ Zip Code: ____________  
      Telephone: ________________________________________________  
      Email: _____________________________________________________

   B. **Partnership [ ]**: Co-partners' Names: ________________________  
      Co-partners' Names: _________________________________________  
      Business Name: ____________________________________________  
      Address: ___________________________________________________  
      ________ Zip Code: ____________  
      Telephone: ________________________________________________  
      Email: _____________________________________________________

   C. **Corporation [ ]**: ________________________________  
      Firm Name: ________________________________________________  
      Address: ___________________________________________________  
      ________ Zip Code ____________  
      Telephone: ________________________________________________
State of Incorporation: ______________________________

President: ________________________________

Secretary: ________________________________

Treasurer: ________________________________

Manager: ________________________________

D. Power of Attorney: Name: ________________________________

Title: ________________________________

E. Contractor License No. _______________ State of ___________

F. Bidder is submitting this proposal on behalf of a Joint Venture. Names, license numbers, and relevant information are given on a separate attachment:

Yes [ ] No [ ]

G. Upon request, furnish appropriate documentation to substantiate and/or support the data given.

9. The undersigned hereby certifies under penalty of perjury under the laws of the State of California that all the information submitted by the Bidder in connection with this Bid and all the representations herein made are true and correct.

Executed this day of ________________________________

Contractor’s License No. Expiration Date

__________________________
Firm Name

__________________________
Signature

__________________________
By (Print or Type Name)

__________________________
Title

End of Section 00300
NONCOLLUSION AFFIDAVIT

(TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID)

State of California
County of Contra Costa

______________________, being first duly sworn, deposes and says that he or she is of ____________________________, the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

I certify (or declare) under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Date: __________________________ Signature: __________________________

State of California
County of Contra Costa

On ________________, before me,______________________________, Notary Public personally appeared ____________________________, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing is true and correct.

WITNESS my hand and official seal.

Date: ______________ Signature: __________________________

END OF SECTION 00350
Contra Costa Community College District (District), in accordance with Public Contract Code Section 20651.5, requires each prospective bidder for a contract, as described under Section 20651, to complete and submit to the district a standardized questionnaire and financial statement in a form specified by the district, including a complete statement of the prospective bidder’s financial ability and experience in performing public works. The questionnaire and financial statement shall be verified under oath by the bidder in the manner in which civil pleadings in civil actions are verified. The questionnaire responses of prospective bidders and their financial statements shall not be deemed public records and shall not be open to public inspection. All information requested must be provided and be current as of the date of the Bid.

I, ________________________________________________ being first duly sworn, depose and say:

(Name)

I am the ___________________________ of _______________ _____________________

(Title) (Company / Entity)

Contact Person: __________________________________________

Address: ________________________________________________

Phone: ___________________ Fax: _________________________

Email: ________________________ Tax ID No.: ______________________

If firm is a sole proprietor or partnership:

Owner(s) of Company _______________________________________

Contractor’s License Number(s): (California State License Board Classification)

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
For Bidders That Are Corporations:

1a. Date incorporated: _________________________________

1b. Under the laws of what state: ___________________________

1c. Provide all the following information for each person who is either (a) an officer of the corporation (president, vice president, secretary, treasurer), or (b) the owner of at least ten per cent of the corporation’s stock.

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Years with Co.</th>
<th>% Ownership</th>
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</table>

1d. Identify every construction firm that any person listed above has been associated with (as owner, general partner, limited partner or officer) at any time during the last five years.

**NOTE:** For this question, “owner” and “partner” refer to ownership of ten per cent or more of the business, or 10 per cent or more of its stock, if the business is a corporation.

<table>
<thead>
<tr>
<th>Person’s Name</th>
<th>Construction Firm</th>
<th>Dates of Person’s Participation with Firm</th>
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**For Bidders That Are Partnerships:**

1a. Date of formation: ________________________________

1b. Under the laws of what state: ________________________________

1c. Provide all the following information for each partner who owns 10 per cent or more of the firm.

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Years with Partnership</th>
<th>% Ownership</th>
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</tbody>
</table>

1d. Identify every construction company that any partner has been associated with (as owner, general partner, limited partner or officer) at any time during the last five years.

**NOTE:** For this question, “owner” and “partner” refer to ownership of ten per cent or more of the business, or ten per cent or more of its stock, if the business is a corporation.

<table>
<thead>
<tr>
<th>Person’s Name</th>
<th>Construction Company</th>
<th>Dates of Person’s Participation with Company</th>
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</table>
For Bidders That Are Sole Proprietorships:

1a. Date of commencement of business. ___________________

1b. Tax ID number of company owner ___________________

1c. Identify every construction firm that the business owner has been associated with (as owner, general partner, limited partner or officer) at any time during the last five years.

**NOTE:** For this question, “owner” and “partner” refer to ownership of ten per cent or more of the business, or ten per cent or more of its stock, if the business is a corporation.

<table>
<thead>
<tr>
<th>Person’s Name</th>
<th>Construction Company</th>
<th>Dates of Person’s Participation with Company</th>
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</table>

For Bidders That Intend to Make a Bid as Part of a Joint Venture:

1a. Date of commencement of joint venture. ___________________

1b. Provide all of the following information for each firm that is a member of the joint venture that expects to bid on one or more projects:

<table>
<thead>
<tr>
<th>Name of Firm</th>
<th>% Ownership of Joint Venture</th>
</tr>
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<tbody>
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</tbody>
</table>
For All Bidders

2. Has there been any change in ownership of the firm at any time during the last five years?
   NOTE: A corporation whose shares are publicly traded is not required to answer this question.
   □ Yes  □ No
   If “yes,” explain on a separate signed page (referring to this question).

3. Is the firm a subsidiary, parent, holding company or affiliate of another construction firm?
   NOTE: Include information about other firms if one firm owns 50 per cent or more of another,
   or if an owner, partner, or officer of your firm holds a similar position in another firm.
   □ Yes  □ No
   If “yes,” explain on a separate signed page (referring to this question).

4. Are any corporate officers, partners or owners connected to any other construction firms?
   NOTE: Include information about other firms if an owner, partner, or officer of your firm
   holds a similar position in another firm.
   □ Yes  □ No
   If “yes,” explain on a separate signed page (referring to this question).

5. List all California construction license numbers, classifications and expiration dates of the
   California contractor licenses held by your firm:
   __________________________________________
   __________________________________________
   If more space is needed add a separate signed page (referring to this question).

6. If any of your firm’s license(s) are held in the name of a corporation or partnership, list below
   the names of the qualifying individual(s) listed on the CSLB records who meet(s) the experience
   and examination requirements for each license.
   __________________________________________
   __________________________________________
   If more space is needed add a separate signed page (referring to this question).

7. Has your firm changed names or license number in the past five (5) years?
   □ Yes  □ No
   If “yes,” explain on a separate signed page, including the reason for the change, and all former
   names under which the firm has conducted business.

8. Has any owner, partner or (for corporations) officer of your firm operated another construction
   firm under any other name in the last five (5) years?
   □ Yes  □ No
   If “yes,” explain on a separate signed page (referring to this question), including the reason for
   the change.
9. Have you attached your latest copy of a REVIEWED OR AUDITED financial statement with accompanying notes and supplemental information?

☐ Yes ☐ No

**NOTE:** A financial statement that is not either reviewed or audited is not acceptable. A letter verifying availability of a line of credit may also be attached; however, it will be considered as supplemental information only, and is not a substitute for the required financial statement.

10. Is the attached Financial Statement for the identical organization of the Bidder?

☐ Yes ☐ No

If “no”, explain the relationship and financial responsibility of the organization whose financial statement of provided (i.e., parent/subsidiary, etc.)

________________________________________________________________________

If more space is needed add a separate signed page (referring to this question).

11. Contractor possesses a VALID AND CURRENT California Contractor’s license for the project or projects for which it intends to submit a bid.

☐ Yes ☐ No

12. List the categories of work your firm typically performs with its own forces, and check the adjacent boxes of those categories of work that will be self-performed on this project

☐ ___________________________________ ☐ ___________________________________

☐ ___________________________________ ☐ ___________________________________

☐ ___________________________________ ☐ ___________________________________

13. On a separate signed page (referring to this question), list all construction projects your organization has in progress and for each project listed, state; (i) a general description of the work performed or to be performed by your organization; (ii) the owner's name, name of the owner's representative, the owner's address and telephone number; (iii) the project architect, address and telephone number; (iv) percent presently completed and (v) the scheduled completion date.

14. On a separate signed page (referring to this question), list all construction projects completed by your organization in the past three years, and for each project, state: (i) a general description of the work performed by your organization on the project; (ii) the owner's name, name of the owner's representative, the owner's address and telephone number; (iii) the initial and final contract amount; (iv) the initial and final dates of completion; and (v) whether the project was completed within contract time and contract budget.

15. Has a claim or other demand ever been made against your organization’s California Contractors License Bond?

Contra Costa Community College District  Diablo Valley College
D-4002 SRC Increment 2 – Expansion & Renovation  Statement of Bidder’s Qualifications

Section 00400 - Page 6 of 10
16. Has a complaint ever been filed against your organization’s California Contractors License with the California Contractors State License Board (CSLB)?

☐ Yes  ☐ No

If yes, on a separate signed page (referring to this question), state the following: (i) the name, address and telephone number of each person or entity making claim or demand; (ii) the date of each claim or demand; (iii) the circumstances giving rise to each such claim or demand; and (iv) the disposition of each such claim or demand.

17. Have any lawsuits or other proceedings ever been brought against your organization or any of its principals or officers in connection with any construction contract or construction project?

☐ Yes  ☐ No

If “yes,” on a separate signed page (referring to this question) describe the circumstances, the amount or relief sought and the disposition of each such lawsuit or other proceeding.

18. Has your organization ever filed a lawsuit or initiated other proceedings in connection with any construction contract or construction project?

☐ Yes  ☐ No

If “yes,” on a separate signed page (referring to this question) describe the circumstances, the amount or relief sought and the disposition of each such lawsuit or other proceeding.

19. Are there any judgments, orders or arbitration awards pending, outstanding or by which your organization or any of its officers or principals are bound by?

☐ Yes  ☐ No

If “yes,” on a separate signed page (referring to this question) describe each such judgment, order or arbitration award and the present status of the satisfaction or discharge thereof.

20. Has any California State License Board (CSLB) license held by your firm, or its Responsible Managing Employee (RME) or Responsible Managing Officer (RMO) been suspended or revoked within the last five (5) years?

☐ Yes  ☐ No

21. Has your organization ever failed to complete a construction contract?

☐ Yes  ☐ No

If “yes,” on a separate signed page (referring to this question) state the following; (i) describe each such contract; (ii) the owner’s name, address and telephone number; (iii) a description of the project; and (iv) the circumstances of the failure to complete.

22. Has your organization ever been declared in default of a construction contract?

☐ Yes  ☐ No
If “yes,” on a separate signed page (referring to this question) state the following: (i) describe each such contract; (ii) the owner’s name, address and telephone number; (iii) a description of the project; and (iv) the circumstances of the declaration of default.

23. Has a claim or other demand ever been asserted against any Bid Bond, Performance Bond or Labor and Material Payment Bond posted by your organization in connection with any construction contract or your submittal of a bid or proposal on a construction contract?
   ☐ Yes ☐ No
   If “yes,” on a separate signed page (referring to this question) state the following: (i) state the name, address and telephone number of each such claimant; (ii) the date of the claim; and (iii) the disposition thereof.

24. At the time of submitting this qualification form, is your firm ineligible to bid on or be awarded a public works contract, or perform as a subcontractor on a public works contract, pursuant to either Labor Code section 1777.1 or Labor Code section 1777.7?
   ☐ Yes ☐ No

25. At any time during the last five (5) years, has your firm, or any of its owners, officers, or partners been convicted of a crime involving the awarding of a contract of a government or Public construction project, or the bidding or performance of a government or Public contract?
   ☐ Yes ☐ No

26. Has your firm or any of its owners, officers, or partners ever been convicted of a crime involving any federal, state, or local law related to bidding, awarding, or performance of any construction contract?
   ☐ Yes ☐ No

27. Has your firm or any of its owners, officers or partners ever been found liable in a civil suit or found guilty in a criminal action for making any false claim or material misrepresentation to any public agency or entity in any way related to any construction contract?
   ☐ Yes ☐ No

28. Is your firm CURRENTLY the debtor in a bankruptcy case?
   ☐ Yes ☐ No

29. In the last twelve (12) months has your firm, or any firm with which any of your company’s owners, officers or partners was associated, been debarred, disqualified, removed or otherwise prevented from bidding on, or completing, any government agency or public works project for any reason?
   ☐ Yes ☐ No
   NOTE: “Associated with” refers to another construction firm in which an owner, partner or officer of your firm held a similar position.
   ☐ Yes ☐ No
   If YES, on a separate signed page (referring to this question) state the following: (i) describe each such project; (ii) the owner’s name, address and telephone number; (iii) the circumstances and specific reason given for being prevented from bidding on or completing the project.

30. Has your organization ever refused to sign a contract awarded to it?
   ☐ Yes ☐ No
If YES, on a separate signed page (referring to this question) state the following: (i) describe each such contract; (ii) the owner's name, address and telephone number; (iii) a description of the project; and (iv) the circumstances of the refusal to sign the contract.

31. In the last twelve (12) months has your firm been denied an award of a public works contract based on a finding by a public agency that your company was NOT a responsible bidder?
   □ Yes □ No
   If YES, on a separate signed page (referring to this question) state the following: (i) describe each such contract; (ii) the owner's name, address and telephone number; (iii) a description of the project; and (iv) the circumstances of the determination.

32. Contractor has CURRENT workers' compensation insurance policy as required by the Labor Code or is legally self-insured pursuant to Labor Code section 3700 et. seq.  
   □ Yes □ No
   □ Contractor is exempt from this requirement, because it has no employees

33. Within the last two (2) years has there ever been a period when your firm had employees but was without Workers' Compensation insurance or state-approved self-insurance?  
   □ Yes □ No

34. Attach to this statement true and correct copies of the following:

   34.1 Your organization's California Contractor's License (the copy must clearly and legibly show: (i) the licensee name; (ii) the expiration date; and (iii) the classification(s) of licensure).

   34.2 The Contractor's License Bond posted by your organization in connection with your organization's California Contractor's License pursuant to California Business & Professions Code 7071.5 and 7071.6 (the copy must clearly and legibly show: (i) the Bond number or other information sufficient for identification; (ii) the name, address and telephone number of the Surety on the Bond; (iii) the signature of the individual executing the Bond on behalf of the Surety and if such individual's authority is conferred by a power of attorney or by such individual's authority is conferred by a power of attorney or by such individual's designation as an attorney in fact on behalf of the Surety, include a clear and legible copy of such power of attorney or attorney in fact designation; (iv) the principal on such Bond; and (v) the expiration date of such Bond).

   34.3 If your organization's California Contractor's License is issued by virtue of the qualification of a responsible managing employee or responsible managing officer of your organization, the Qualifier's Bond, if required pursuant to California business & Professions Code 7071.9 (the copy must clearly and legibly show: (i) the bond number or other information sufficient for identification; (ii) the name, address and telephone number of the Surety on the Bond; (iii) the signature of the individual executing the Bond on behalf of the Surety and if such individual's authority is conferred by a power of attorney or by such individual's designation as an attorney in fact on behalf of the Surety, include a clear and legible copy of such power of attorney or attorney in fact designation; (iv) the principal on such Bond; and (v) the expiration date of such Bond).

35. Certification

Contra Costa Community College District
Diablo Valley College
D-4002 SRC Increment 2 – Expansion & Renovation
The responses to each and all of the foregoing are complete and accurate; there are no omissions of material fact or information such that would render any of the foregoing false or misleading; there are no misstatements of fact in any of the foregoing.

I, the undersigned, certify and declare that I have read all the foregoing answers to this Section and know their contents. The matters stated in the above answers are true of my own knowledge and belief, except as to those matters stated on information and belief, and as to those matters I believe them to be true. I declare under penalty of perjury under the laws of the State of California, that the foregoing is correct.

Dated: ______________

_________________________________________
(Printed Name)

_________________________________________
(Signature)

NOTARY PUBLIC

ACKNOWLEDGEMENT (By Corporation, Partnership or Individual)

STATE OF CALIFORNIA 

COUNTY OF CONTRA COSTA 

On ______________, before me, _____________________________, Notary Public,

personally appeared _______________________________, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing is true and correct.

Witness my hand and official seal.

_________________________________________
Notary Public

[SEAL]

END OF SECTION 00400
Gentlemen/Ladies:

I visited the **D-4002 DVC San Ramon Campus Increment 2 – Expansion and Renovation**

job site, on ______________ at ______________ A.M. P.M (Circle one)

to inspect the proposed work, which would be turned over to me in its present condition, with a representative of the Contra Costa Community College District in order to acquaint myself with the proposed work so that I might fully understand the facilities, difficulties, and restrictions attending the execution of the work under the contract, and acknowledge I had the opportunity to check the Record Drawing as-built drawings and/or previous Contract Documents, site conditions and Bid Documents with the authorized representative of the District.

**Owner Representative:**

________________________________________________________________________  Date

**Project Manager – CCCCD Facilities**

or

________________________________________________________________________  Date

**Manager – Buildings & Grounds**

**Bidder:**

________________________________________________________________________

**Name of Firm or Company**

________________________________________________________________________

**Authorized Signatory**

________________________________________________________________________

**Address**

Phone Number  Fax Number

**NOTE:** Any bidder who fails to return this CERTIFICATION, fully executed, including signature of company representative AND a Contra Costa Community College District representative, with the proposal form, may have their bid rejected as non-responsive.

**END OF SECTION 00450**
PAYMENT BOND  
(CALIFORNIA PUBLIC WORK)

KNOW ALL MEN BY THESE PRESENTS:

THAT WHEREAS, the Contra Costa Community College District (sometimes referred to hereinafter as “Obligee”) has awarded to __________________________________ (hereinafter designated as the “Principal” or “Contractor”), an agreement for the work described as follows: __________________________________ (hereinafter referred to as the “Public Work”); and

WHEREAS, said Contractor is required to furnish a bond in connection with said Contract, and pursuant to California Civil Code Section 9550;

NOW, THEREFORE, We, _______________________________________, the undersigned Contractor, as Principal; and ________________________________, a corporation organized and existing under the laws of the State of ________________, and duly authorized to transact business under the laws of the State of California, as Surety, are held and firmly bound unto the Contra Costa Community College District and to any and all persons, companies, or corporations entitled by law to file stop notices under California Civil Code Section 9100, or any person, company, or corporation entitled to make a claim on this bond, in the sum of ____________________ Dollars ($_____________), said sum being not less than one hundred percent (100%) of the total amount payable by said Obligee under the terms of said Contract, for which payment will and truly to be made, we bind ourselves, our heirs, executors and administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if said Principal, its heirs, executors, administrators, successors, or assigns, shall fail to pay any person or persons named in Civil Code Section 9100; or fail to pay for any materials, provisions, or other supplies, used in, upon, for, or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, or for amounts due under the Unemployment Insurance Code, with respect to work or labor thereon of any kind; or shall fail to deduct, withhold, and pay over to the Employment Development Department, any amounts required to be deducted, withheld, and paid over by Unemployment Insurance Code Section 13020 with respect to work and labor thereon of any kind, then said Surety will pay for the same, in an amount not exceeding the amount herein above set forth, and in the event suit is brought upon this bond, also will pay such reasonable attorneys’ fees as shall be fixed by the court, awarded and taxed as provided in California Civil Code Sections 9550 et seq.

This bond shall inure to the benefit of any person named in Civil Code Section 9100 giving such person or his/her assigns a right of action in any suit brought upon this bond.

It is further stipulated and agreed that the Surety of this bond shall not be exonerated or released from the obligation of the bond by any change, extension of time for performance, addition, alteration or modification in, to, or of any contract, plans, or specifications, or agreement pertaining or relating to any scheme or work of improvement herein above described; or pertaining or relating to the furnishing of labor, materials, or equipment therefor; nor by any change or modification of any terms of payment or extension of time for payment pertaining or
relating to any scheme or work of improvement herein above described; nor by any rescission or attempted rescission of the contract, agreement or bond; nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such contract or agreement or under the bond; nor by any fraud practiced by any person other than the claimant seeking to recover on the bond; and that this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given; and under no circumstances shall the Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach of contract between the Obligee and the Contractor or on the part of any obligee named in such bond; that the sole condition of recovery shall be that the claimant is a person described in California Civil Code Sections 9100, and who has not been paid the full amount of his or her claim; and that the Surety does hereby waive notice of any such change, extension of time, addition, alteration or modification herein mentioned.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this __________ day of ____________, 20____.

PRINCIPAL/CONTRACTOR:

______________________________

By: ____________________________

SURETY:

______________________________

By: ____________________________

Attorney-in-Fact
IMPORTANT: THIS IS A REQUIRED FORM.

Surety companies executing bonds must possess a certificate of authority from the California Insurance Commissioner authorizing them to write surety insurance defined in California Insurance Code Section 105, and if the work or project is financed, in whole or in part, with federal, grant or loan funds, Surety’s name must also appear on the Treasury Department’s most current list (Circular 570 as amended).

Any claims under this bond may be addressed to:

(Name and Address of Surety)   (Name and Address of agent or representative for service for service of process in California)

Telephone: ___________________   Telephone: ___________________

STATE OF CALIFORNIA )
) ss.
COUNTY OF )

On ___________________________ before me, ______________________________________,
(insert name and title of the officer)
a Notary Public in and for said State, personally appeared ____________________________, who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument as the Attorney-in-Fact of the _____________________ (Surety) and acknowledged to me that he/she/they subscribed the name of the _____________________ (Surety) thereto and his own name as Attorney-in-Fact on the executed instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

_____________________________________ (SEAL)

Notary Public in and for said State

Commission expires: ___________________

NOTE: A copy of the power-of-attorney to local representatives of the bonding company must be attached hereto.
CONTRACT PERFORMANCE BOND
(CALIFORNIA PUBLIC WORK)

KNOW ALL MEN BY THESE PRESENTS:

THAT WHEREAS, Contra Costa Community College District (sometimes referred to hereinafter as “Obligee”) has awarded to ______________________________________ (hereinafter designated as the “Principal” or “Contractor”), an agreement for the work described as follows: ____________________________________ (hereinafter referred to as the “Public Work”); and

WHEREAS, the work to be performed by the Contractor is more particularly set forth in that certain contract for said Public Work dated ______________ ____________________, (hereinafter referred to as the “Contract”), which Contract is incorporated herein by this reference; and

WHEREAS, the Contractor is required by said Contract to perform the terms thereof and to provide a bond both for the performance and guaranty thereof.

NOW, THEREFORE, we, ______________________________________, the undersigned Contractor, as Principal, and ______________________________________, a corporation organized and existing under the laws of the State of ______________, and duly authorized to transact business under the laws of the State of California, as Surety, are held and firmly bound unto the Contra Costa Community College District in the sum of ______________________________________ Dollars ($_______________), said sum being not less than one hundred percent (100%) of the total amount payable by said Obligee under the terms of said Contract, for which amount well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if the bounded Contractor, his or her heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions, and agreements in said Contract and any alteration thereof made as therein provided, on his or her part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their intent and meaning; and shall faithfully fulfill guarantees of all materials and workmanship; and indemnify, defend and save harmless the Obligee, its officers and agents, as stipulated in said Contract, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect.

The Surety, for value received, hereby stipulates and agrees that it shall not be exonerated or released from the obligation of this bond (either by total exoneration or pro tanto) by any change, extension of time, alteration in or addition to the terms of the contract or to the work to be performed there under or the specifications accompanying the same, nor by any change or modification to any terms of payment or extension of time for any payment pertaining or relating to any scheme of work of improvement under the contract. Surety also stipulates and agrees that it shall not be exonerated or released from the obligation of this bond (either by total exoneration or pro tanto) by any overpayment or underpayment by the Obligee that is based upon estimates
approved by the Architect. The Surety stipulates and agrees that none of the aforementioned changes, modifications, alterations, additions, extension of time or actions shall in any way affect its obligation on this bond, and it does hereby waive notice of any such changes, modifications, alterations, additions or extension of time to the terms of the contract, or to the work, or the specifications as well notice of any other actions that result in the foregoing.

Whenever Principal shall be, and is declared by the Obligee to be, in default under the Contract, the Surety shall promptly either remedy the default, or shall promptly complete the Contract through its agents or independent contractors, subject to acceptance and approval of such agents or independent contractors by Obligee as hereinafter set forth, in accordance with its terms and conditions and to pay and perform all obligations of Principal under the Contract, including, without limitation, all obligations with respect to warranties, guarantees and the payment of liquidated damages; or, at Obligee’s sole discretion and election, Surety shall obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Obligee of the lowest responsible bidder, arrange for a contract between such bidder and the Obligee and make available as Work progresses (even though there should be a default or succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the “balance of the Contract price” (as hereinafter defined), and to pay and perform all obligations of Principal under the Contract, including, without limitation, all obligations with respect to warranties, guarantees and the payment of liquidated damages. The term “balance of the Contract price,” as used in this paragraph, shall mean the total amount payable to Principal by the Obligee under the Contract and any modifications thereto, less the amount previously paid by the Obligee to the Principal, less any withholdings by the Obligee allowed under the Contract.

Surety expressly agrees that the Obligee may reject any agent or contractor which may be proposed by Surety in fulfillment of its obligations in the event of default by the Principal. Unless otherwise agreed by Obligee, in its sole discretion, Surety shall not utilize Principal in completing the Contract nor shall Surety accept a bid from Principal for completion of the work in the event of default by the Principal.

No final settlement between the Obligee and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

The Contractor and Surety shall remain responsible and liable for all patent and latent defects that arise out of or are related to the Contractor’s failure and/or inability to properly complete the Public Work as required by the Contract and the Contract Documents. The obligation of the Surety hereunder shall continue so long as any obligation of the Contractor remains.

Contractor and Surety agree that if the Obligee is required to engage the services of an attorney in connection with enforcement of the bond, Contractor and Surety shall pay Obligee’s reasonable attorneys’ fees incurred, with or without suit, in addition to the above sum.

In the event suit is brought upon this bond by the Obligee and judgment is recovered, the Surety shall pay all costs incurred by the Obligee in such suit, including reasonable attorneys’ fees to be fixed by the Court.
IN WITNESS WHEREOF, we have hereunto set our hands and seals this ____ day of ______________, 201_.

PRINCIPAL/CONTRACTOR:

__________________________________________

By: _______________________________________

SURETY:

__________________________________________

By: _______________________________________

Attorney-in-Fact

The rate of premium on this bond is ______________________________ per thousand.

The total amount of premium charged: $__________________________ (This must be filled in by a corporate surety).

IMPORTANT: THIS IS A REQUIRED FORM.

Surety companies executing bonds must possess a certificate of authority from the California Insurance Commissioner authorizing them to write surety insurance defined in California Insurance Code Section 105, and if the work or project is financed, in whole or in part, with federal, grant or loan funds, Surety’s name must also appear on the Treasury Department’s most current list (Circular 570 as amended).

Any claims under this bond may be addressed to:

(Name and Address of Surety) (Name and Address of agent or representative for service for service of process in California)

__________________________________________  __________________________________________

__________________________________________  __________________________________________

Telephone:__________________________  Telephone: ______________________________
STATE OF CALIFORNIA  

COUNTY OF  

On ___________________________ before me, ______________________________________ (insert name and title of the officer) 

On ____________________________, before me, _________________________, a Notary Public in and for said State, personally appeared ________________________________, who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument as the Attorney-in-Fact of the _____________________ (Surety) and acknowledged to me that he/she/they subscribed the name of the _____________________ (Surety) thereto and his own name as Attorney-in-Fact on the executed instrument. 

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct. 

WITNESS my hand and official seal. 

______________________________ (SEAL) 

Notary Public in and for said State 

Commission expires:_________________________ 

NOTE: A copy of the power-of-attorney to local representatives of the bonding company must be attached hereto.
SECTION 00510

NOTICE OF AWARD

DATE: _____________________

TO: _____________________________________________

ADDRESS: _______________________________________

PROJECT: ________________________________________

The Contract Sum of your contract is ____________________________ Dollars, ($______________).

You must comply with the following conditions within ten (10) calendar days of the date of this Notice of Award, that is, by ________________:

1. You must deliver to the District two fully executed counterparts of Section 00600, “Construction Agreement.”

2. You must deliver to the District the “Contract Performance Bond,” and “Payment Bond,” executed by you and your surety, which are included in Section 00500.

3. You must deliver to District the insurance certificates required in Section 00700, for insurance required in Section 00600, Construction Agreement.

Failure to comply with these conditions within the time specified will entitle District to consider your bid abandoned, to annul this Notice of Award, and to declare your Bid Security forfeited. Within ten (10) calendar days after you comply with these conditions, the District will return to you one fully signed counterpart of the Construction Agreement.

Contra Costa Community College District

By: _____________________________________________

Title: _____________________________________________

END OF DOCUMENT
This Agreement shall not be enforceable until ratified and approved by the Contra Costa Community College District’s Governing Board. The estimated board meeting date is January 23, 2019.

($1.1) Parties: (Public Agency) CONTRA COSTA COMMUNITY COLLEGE DISTRICT
500 Court St, Martinez, CA 94553

(Contractor) __________________________
Address: ____________________________

($1.2) Effective Date: ________________

($1.3) The Work: D-4002 DVC San Ramon Campus Expansion and Renovation Increment 2

($1.4) Substantial Completion Time: Increment 2: **425 Calendar Days from** the Notice to Proceed.

($1.4.1) Final Completion 30 Calendar Days from Substantial Completion

($1.5) The Bidder acknowledges that this must be substantially completed and accepted by the Owner before a written “Notice to Proceed” is issued for the next phase of the Project. Bidder also agrees to pay, as liquidated damages the amounts specified below for each consecutive calendar day after the expiration of the consecutive calendar days allowed.

($1.5.1) Liquidated Damages, Substantial Completion:
Increment 1 - $1,000 / per calendar day Work is delayed

($1.5.2) Liquidated Damages, Remaining Work, All Phases and Final Completion: $1,000 / per calendar day Remaining Work is delayed

($1.6) Public Agency’s Agent: CONTRA COSTA COMMUNITY COLLEGE DISTRICT (“District”)

($1.7) Contract Sum: $00,000,000.00 DOLLARS and NO CENTS
2. **SCOPE OF WORK:**
The Overall Project Summary consists of renovations to portions of the existing instructional buildings as well as the construction of a new 6600 SF Library and Learning Resource Center and site improvements.

San Ramon Campus Expansion and Renovation Increment 2 Work includes but is not limited to: renovations to portions of the existing instructional buildings as well as the construction of a new 6600 SF Library and Learning Resource Center and site improvements.

Increment 2 Work includes, but is not limited to:

1. Renovations at the Learning Commons
2. Renovations at the existing West Building for a new Café, including site improvements for a grease interceptor and trash/recycle/compost enclosure
3. Accessibility upgrades to existing restrooms as needed
5. Site Improvement at the new LLRC, including subgrade preparations, rerouting of existing underground utilities, extension of utilities to serve the new buildings and landscape improvements

3. **WORK CONTRACT, CHANGES**

(a) By their signatures below, effective on the above date, these parties promise and agree as set forth in this Agreement, incorporating by these references labor and materials contained in Section 2, Scope of Work.

(b) Contractor shall, at Contractor's own cost and expense, and in a workmanlike manner, fully and faithfully perform and complete the work; and will furnish all materials, labor, services, equipment, and transportation necessary, convenient and proper in order fairly to perform the requirements of this contract, all strictly in accordance with the Public Agency's plans, drawings and specifications.

(c) The work can be changed only with Public Agency's prior written order specifying such change and its cost agreed to by the parties; and the Public Agency shall never have to pay more than specified in Section 1.7 without such an order.

4. **TIME: NOTICE TO PROCEED AND ACCEPTANCE**

(a) Contractor shall start this work as directed in the specifications or the Notice to Proceed and shall complete it as specified in Section 1, Completion Time.

(b) Partial Acceptance – If at any time during the prosecution of the project, the Contractor substantially completes the Phase of Work of the Project, the Contractor may request the District to make an inspection of the Phase of Work. If the District finds upon inspection that the Phase of Work has been satisfactorily completed in compliance with the contract, the District may accept that Phase of Work as being completed provided that the Contractor shall remain responsible for completion of any Remaining Work of such Phase of the Project. Phases of Work of the project eligible for the Partial Acceptance allowed in this paragraph shall be identified specifically in the Contract Documents as Phases of Work to be eligible for Partial Acceptance. Such Partial Acceptance shall in no way void or alter any of the terms of the Contract.
(c) Remaining Work after Substantial Completion. If the Architect or District determines that the work required by the Contract is Substantially Complete during any inspection conducted pursuant to this Agreement or Specification Section 01770, Contract Closeout Procedures, the Contractor shall be notified of that determination and the District shall determine if there is Remaining Work. A list of Remaining Work shall be issued only by the District or the Architect and only after the District has certified Substantial Completion. The District or Architect shall give the Contractor the necessary instructions for correction or completion of the Remaining Work, and the Contractor shall immediately comply with and execute such instructions within the Contract Time. Upon completion of the Remaining Work, another inspection shall be made that shall constitute the Final Inspection, provided the Remaining Work has been completed to the satisfaction of the District. If the remaining work has been completed to the satisfaction of the District, the District shall make the final acceptance and notify the Contractor in writing of this acceptance as of the date of Final Inspection.

(d) Final Acceptance – Upon due notice from the Contractor of completion of the entire project, the District shall make an inspection. If all construction provided for and contemplated by the contract is found to be completed to the District’s satisfaction, then that inspection shall constitute the Final Inspection and the District shall notify the Contractor in writing of final acceptance effective as of the date of the Final Inspection.

(e) Default for failure to Complete Remaining Work In the event the Contract Time expires before the Remaining Work is completed to the satisfaction of the District, the District may provide notice to the Contractor that the Remaining Work shall be completed by Contractor to the satisfaction of the District within ten consecutive calendar days from the date of such notice. The failure of the Contractor to satisfactorily complete the Remaining Work within the ten days shall entitle to District to declare Contractor in default and thereafter terminate the Contract. The ten-day notice provided under this paragraph shall not be construed as adding any time to the Contract Time and is a time period solely for the purposes of providing notice of default.

(f) Application for Final Payment. After the Contractor has completed all Remaining Work to the satisfaction of the District and delivered all maintenance and operating instructions, schedules, guarantees, warranties, bonds, certificates of inspection, marked-up record documents and other documents as required by the Contract, and after the District or Architect has indicated that the work is acceptable, Contractor may make application for final payment following the Payments Procedures for progress payments. The final application for payment shall be accompanied by all documentation called for in the Contract Documents, together with complete and legally effective releases or waivers (satisfactory to the District) of all liens arising out of or filed in connection with the work on the project.

(g) Final Payment and Acceptance. If the Architect determines that the work has been completed and the Contractor’s other obligations under the Contract have been fulfilled, the Architect shall, within ten working days after receipt of the final application for payment, indicate in writing the Architect’s recommendation of payment and present the application to District for payment. Thereupon the Architect shall prepare a Certificate of Final Completion. Otherwise, Architect shall return the application to Contractor indicating in writing the reasons for refusing to recommend final payment. Contractor shall make the corrections identified in the Architect’s refusal to
recommend final payment. Thirty days after presentation to District of the application and accompanying documentation, with the Architect’s recommendation and notice of acceptability of the work, the amount recommended by Architect shall be come due and payable by District to Contractor.

5. LIQUIDATED DAMAGES

5.1 LIQUIDATED DAMAGES - SUBSTANTIAL COMPLETION

If the Contractor fails to complete this contract and this Work or Phase of Work within the time fixed therefore, allowance being made for contingencies as provided herein, Contractor becomes liable to the Public Agency for all its loss and damage there from; and because, from the nature of the case, it is and will be impracticable and extremely difficult to ascertain and fix the Public Agency's actual damage from any delay in performance hereof, it is agreed that Contractor will pay as liquidated damages to the Public Agency the reasonable sum specified in Section 1, the result of the parties’ reasonable endeavor to estimate fair average compensation therefore, for each calendar day delay in finishing said Work or Phase of Work; and if the same be not paid, Public Agency may, in addition to its other remedies, deduct the same from any money due or to become due Contractor under this Contract. If the Public Agency for any cause authorizes or contributes to a delay, suspension of work or extension of time, its duration shall be added to the time allowed for completion, but it shall not be deemed a waiver nor be used to defeat any right of the Agency to damages for non-completion or delay hereunder. Pursuant to Government Code Section 4215, the Contractor shall not be assessed liquidated damages for delay in completion of the work, when such delay was caused by the failure of the Public Agency or the owner of a utility to provide for removal or relocation of existing utility facilities.

5.2 LIQUIDATED DAMAGES-THE REMAINING WORK.

The Remaining Work, as such work is determined by the Public Agency or Public Agency's Representative, shall be completed within the Contract Time or any proper extension thereof granted by Public Agency. If the Contractor shall neglect, fail or refuse to complete the Remaining Work within the Contract Time or any proper extension thereof granted by the Public Agency, then the Contractor does hereby agree, as part consideration for the awarding of this Contract, to pay to the Public Agency the amount specified in the Contract, not as a penalty but as liquidated damages for the Remaining Work for each such breach of Contract set forth herein for each and every consecutive calendar day that the Contractor shall be in default after expiration of the Contract Time.

6. INTEGRATED DOCUMENTS

The plans, drawings and specifications and special provisions of the Public Agency's Notice Inviting Bids, and Contractor's accepted bid for this work are hereby incorporated into this Contract; and they are intended to cooperate, so that anything exhibited in the plans or drawings and not mentioned in the specifications or special provisions, or vice versa, is to be executed as if exhibited, mentioned and set forth in both, to the true intent and meaning thereof when taken all together; and differences of opinion concerning these shall be finally determined by the Public Agency.
7. **PAYMENT**

(a) For strict and literal fulfillment of these promises and conditions, and full compensation for all this work, the Public Agency shall pay the Contractor the sum specified in Section 1, except that in unit price contracts the payment shall be for finished quantities at unit bid prices.

(b) On or about the first day of each calendar month, the Contractor shall submit to the Public Agency a verified application for payment, supported by a statement showing all materials actually installed during the preceding month, the labor expended thereon, and the cost thereof; whereupon, after checking, the Public Agency shall issue to Contractor a certificate for the amount determined to be due, minus five (5%) percent thereof pursuant to the Public Agency’s General Terms and Conditions, but not until defective work and materials have been removed, replaced and made good.

8. **PAYMENTS WITHHELD**

(a) The Public Agency or its agent may withhold any payment, or because of later discovered evidence nullify all or any certificate for payment, to such extent and period of time only as may be necessary to protect the Public Agency from loss because of:

1. Defective work not remedied, or work not completed, or
2. Claims filed or reasonable evidence indicating probable filing, or
3. Failure to properly pay subcontractors or for material or labor, or
4. Reasonable doubt that the work can be completed for the balance then unpaid, or
5. Damage to another contractor, or
6. Damage to the Public Agency, other than damage due to delays.

(b) The Public Agency shall use reasonable diligence to discover and report to the Contractor, as the work progresses, the materials and labor which are not satisfactory to it, so as to avoid unnecessary trouble or cost to the Contractor in making good any defective work or parts.

(c) Thirty-five (35) calendar days after Public Agency files its notice of completion of the entire work, it shall issue a certificate to the Contractor and pay the balance of the contract price after deducting all amounts withheld under this contract, provided the Contractor shows that all claims for labor and materials have been paid, no claims have been presented to the Public Agency based on acts or omissions of the Contractor, and no liens or withhold notices have been filed against the work or site, and provided there are not reasonable indications of defective or missing work or of late-recorded notices of liens or claims against Contractor.

9. **INSURANCE**

Before the commencement of the Work, the Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in California as admitted carriers with a financial rating of at least A status as rated in the most recent edition of Best’s Insurance Reports or as amended by the Supplementary General Conditions, such insurance as will protect the Public Agency from claims set forth below, which may arise out of or result from the Contractor’s operations under the Contract and for which the Contractor may be legally liable, whether such operations are by the Contractor, by a Subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.
a. Claims for damages because of bodily injury, sickness, disease, or death of any person District would require indemnification and coverage for employee claim;
b. Claims for damages insured by usual personal injury liability coverage, which are sustained by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor or by another person;
c. Claims for damages because of injury or destruction of tangible property, including loss of use resulting therefrom, arising from operations under the Contract Documents;
d. Claims for damages because of bodily injury, death of a person, or property damage arising out of the ownership, maintenance, or use of a motor vehicle, all mobile equipment, and vehicles moving under their own power and engaged in the Work;
e. Claims involving contractual liability applicable to the Contractor’s obligations under the Contract Documents, including liability assumed by and the indemnity and defense obligations of the Contractor and the Subcontractors; and
f. Claims involving Completed Operations, Independent Contractors’ coverage, and Broad Form property damage, without any exclusions for collapse, explosion, demolition, underground coverage, and excavating. (XCU)
g. Claims involving sudden or accidental discharge of contaminants or pollutants.

Additional Insured Endorsement Requirement: The Contractor shall name, on any policy of insurance, the District, Architect, Inspector, the State of California, their officers, employees, agents and independent contractors as Additional Insured. Subcontractors shall name the Contractor, the District, Architect, Inspector, Project / Construction Manager, the State of California, their officers, employees, agents and independent contractors as Additional Insured.

The Additional Insured Endorsement included on all such insurance policies shall state that coverage is afforded the additional insured with respect to claims arising out of operations performed by or on behalf of the insured. If the Additional Insured have other insurance which is applicable to the loss, such other insurance shall be on an excess or contingent basis. The insurance provided by the Contractor must be designated in the policy as primary to any insurance obtained by the Public Agency. The amount of the insurer’s liability shall not be reduced by the existence of such other insurance.

Specific Insurance Requirement: Contractor shall take out and maintain and shall require all subcontractors, if any, whether primary or secondary, to take out and maintain:
a) Comprehensive General Liability Insurance with an aggregate of not less than $[10,000,000.00]; Per occurrence, $[5,000,000.00]
b) Automotive (any auto) where operated in amounts $[1,000,000.00]
c) Workers’ Compensation Insurance: $[1,000,000.00]; Contractor is aware of and complies with Labor Code Section 3700 and the Worker’s Compensation Law.

10. BONDS

Bond Requirements: Prior to commencing any portion of the Work, the Contractor shall furnish separate payment and performance bonds for its portion of the Work which shall cover 100% faithful performance of and payment of all obligations arising under the Contract Documents and/or guaranteeing the payment in full of all claims for labor performed and materials supplied for the Work. All bonds shall be provided by a corporate surety authorized and admitted to transact business in California as sureties.
To the extent, if any, that the Contract Price is increased in accordance with the Contract Documents, the Contractor shall, upon request of the Public Agency, cause the amount of the bonds to be increased accordingly and shall promptly deliver satisfactory evidence of such increase to the Public Agency. To the extent available, the bonds shall further provide that no change or alteration of the Contract Documents (including, without limitation, an increase in the Contract Price, as referred to above), extensions of time, or modifications of the time, terms, or conditions of payment to the Contractor will release the surety. If the Contractor fails to furnish the required bonds, the Public Agency may terminate the Contract for cause.

On signing this contract, Contractor shall deliver to Public Agency for approval good and sufficient bonds with sureties, in amount(s), specified in the specifications or special provisions, guaranteeing faithful performance of this contract and payment for all labor and materials hereunder.

11. FAILURE TO PERFORM

If the Contractor at any time refuses or neglects, without fault of the Public Agency or its agent(s), to supply sufficient materials or workers to complete this agreement and work as provided herein, for a period of ten days or more after written notice thereof by the Public Agency, the Public Agency may furnish same and deduct the reasonable expenses thereof from the contract price.

12. LAWS APPLY: General

Both parties recognize the applicability of various federal, state and local laws and regulations, especially Chapter 1 of Part 7 of the California Labor Code (beginning with Section 1720, and including Sections 1735, 1777.5, 1777.6, forbidding discrimination) and intend that this agreement complies therewith. The parties specifically stipulate that the relevant penalties and forfeitures provided in the Labor Code, especially in Sections 1775, 1776, and 1813, concerning prevailing wages and hours, shall apply to this agreement as though fully stipulated herein.

13. SUBCONTRACTORS

Public Contract Code Sections 4100-4113 are incorporated herein.

14. WAGE RATES

(a) Pursuant to Labor Code Section 1773, the Director of the Department of Industrial Relations has ascertained the general prevailing rates of wages per diem, and for holiday and overtime work, in the locality in which this work is to be performed, for each craft, specified in the call for bids for this work and are on file with the Public Agency, and are hereby incorporated herein.

(b) This schedule of wages is based on a working day of eight (8) hours unless otherwise specified; and the daily rate is the hourly rate multiplied by the number of hours constituting the working day. When less than that number of hours are worked, the daily wage range is proportionately reduced, but the hourly rate remains as stated.

(c) The Contractor, and all subcontractors, must pay at least these rates to all persons on this work, including all travel, subsistence, and fringe benefit payments provided for by applicable collective bargaining agreements. All skilled labor not listed above must be paid at least the wage scale established by collective bargaining agreement for such labor in the locality where such work is being performed. If it becomes necessary for the Contractor or any subcontractor to employ any person in a craft, classification or type of work (except executive, supervisory, administrative,
clerical or other non-manual workers as such) for which no minimum wage rate is specified, the contractor shall immediately notify the Public Agency which shall promptly determine the prevailing wage rate therefore and furnish the Contractor with the minimum rate based thereon, which shall apply from the time of the initial employment of the person affected and during the continuance of such employment.

15. **HOURS OF LABOR**

Eight hours of labor in one calendar day constitutes a legal day's work, and no worker employed at any time on this work by the Contractor or by any subcontractor shall be required or permitted to work longer thereon except as provided in Labor Code Sections 1810-1815.

16. **APPRENTICES**

Properly indentured apprentices may be employed on this work in accordance with Labor Code Sections 1777.5 and 1777.6, forbidding discrimination.

17. **PREFERENCE FOR MATERIALS**

The Public Agency desires to promote the industries and economy of Contra Costa County, and the Contractor therefore promises to use the products, workers, laborers and mechanics of this County in every case where the price, fitness and quality are at least equal.

18. **ASSIGNMENT**

This agreement binds the heirs, successors, assigns, and representatives of the Contractor; but Contractor cannot assign it in whole or in part, nor any monies due or to become due under it, without the prior written consent of the Public Agency and the Contractor's surety or sureties, unless they have waived notice of assignment.

19. **NO WAIVER BY PUBLIC AGENCY**

Inspection of the work and/or materials, or approval of work and/or materials inspected, or statement by any officer, agent or employee of the Public Agency indicating the work or any part thereof complies with the requirements of this contract, or acceptance of the whole or any part of said work and/or materials, or payments therefore, or any combination of these acts, shall not relieve the Contractor of Contractor's obligation to fulfill this contract as prescribed; nor shall the Public Agency be thereby stopped from bringing any action for damages or enforcement arising from the failure to comply with any of the terms and conditions hereof.

20. **HOLD HARMLESS AND INDEMNITY**

(a) Contractor promises to and shall hold harmless and indemnify from the liabilities as defined in this section.
(b) The indemnities benefited and protected by this promise are the Public Agency and its elective and appointive boards, commissions, officers, agents and employees.

(c) The liabilities protected against are any liability or claim for damage of any kind allegedly suffered, incurred or threatened because of actions defined below, including personal injury, death, property damage, inverse condemnation, or any combination of these, regardless of whether or not such liability, claim or damage was unforeseeable at any time before the Public Agency approved the improvement plan or accepted the improvements as completed, and including the defense of any suit(s) or action(s) at law or equity concerning these.

(d) The actions causing liability are any act or omission (negligent or non-negligent) in connection with the matters covered by this contract and attributable to the contractor, subcontractor(s), or any officer(s), agent(s), or employee(s) of one or more of them.

(e) Non-conditions: The promise and agreement in this section is not conditioned or dependent on whether or not any Indemnities has prepared, supplied, or approved any plan(s), drawing(s), specifications(s) or special provision(s) in connection with this work, has insurance or other indemnification covering any of these matters, or that the alleged damage resulted partly from any negligent or willful misconduct of any Indemnities.

21. EXCAVATION

Contractor shall comply with the provisions of Labor Code Section 6705, if applicable, by submitting to Public Agency a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during trench excavation.

22. GOVERNMENT CODE SECTION 10532

Contractor shall be subject to the examination and audit of the Auditor General for a period of three years after final payment under the contract.

23. WARRANTY

(a) In addition to any other warranties or guaranties in the Contract Documents, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the Work or Phase of Work, unless otherwise provided or extended in the Contract Documents. If the District takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the District takes possession.

(c) The Contractor shall remedy at the Contractor’s expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor’s expense any damage to District-owned or controlled real or personal property, when that damage is the result of—

(1) The Contractor’s failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.
(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor’s warranty with respect to work repaired or replaced will run for 1 year or as otherwise provided or extended from the date of repair or replacement.

(e) The District shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the District shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor’s expense.

(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall—

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the District, if directed by the District; and

(3) Enforce all warranties for the benefit of the District, if directed by the District.

(h) In the event the Contractor’s warranty under paragraph (b) of this clause has expired, the District may bring suit at its expense to enforce a subcontractor’s, manufacturer’s, or supplier’s warranty.

(i) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the District nor for the repair of any damage that results from any defect in District-furnished material or design.

(j) This warranty shall not limit the District’s rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

24. CONSEQUENTIAL DAMAGES

The Contractor and Public Agency waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

(a) Damages incurred by the Public Agency for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

(b) Damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.
This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination. Nothing contained in this subparagraph shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

25. HAZARDOUS MATERIALS

(a) If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos, lead or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Public Agency in writing.

(b) The Public Agency shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. The Public Agency shall furnish in writing to the Contractor the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written notification from the Public Agency and Contractor. The Contract Time shall be extended appropriately.

26. SAFETY

a. Safety Programs. In addition to and as required by other Sections of the Contract Documents, the Contractor shall be solely responsible for initiating, maintaining and supervising all safety programs required by applicable law, ordinance, regulation or governmental orders in connection with the performance of the Contract, or otherwise required by the type or nature of the Work. The Contractor's safety program shall include all actions and programs necessary for compliance with California or federally statutorily mandated workplace safety programs, including without limitation, compliance with the California Drug Free Workplace Act of 1990 (California Government Code §§8350 et seq.). Without limiting or relieving the Contractor of its obligations hereunder, the Contractor shall require that its Subcontractors similarly initiate and maintain all appropriate or required safety programs. Prior to commencement of Work, the Contractor shall meet with the campus Buildings and Grounds Manager, Project Manager, and Construction Manager to review Contractor's safety precautions and implementation of safety programs during the Work.

b. Safety Precautions. In addition to and as required by other Sections of the Contract Documents, the Contractor shall be solely responsible for initiating and maintaining reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (i) employees on the Work and other persons who may be affected thereby; (ii) the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-
subcontractors; and (iii) other property or items at the site of the Work, or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction. The Contractor shall take adequate precautions and measures to protect existing roads, sidewalks, curbs, pavement, utilities, adjoining property and improvements thereon (including without limitation, protection from settlement or loss of lateral support) and to avoid damage thereto. Without adjustment of the Contract Price or the Contract Time, the Contractor shall repair, replace or restore any damage or destruction of the foregoing items as a result of performance or installation of the Work.

c. **Safety Signs, Barricades.** In addition to and as required by other Sections of the Contract Documents, the Contractor shall erect and maintain, as required by existing conditions and conditions resulting from performance of the Contract, reasonable safeguards for safety and protection of property and persons, including, without limitation, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying Districts and users of adjacent sites and utilities.

d. **Safety Notices.** In addition to and as required by other Sections of the Contract Documents, the Contractor shall give or post all notices required by applicable law and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

### 27. PROJECT STABILIZATION AGREEMENT

1. Definitions. As used in this clause— “Project Stabilization Agreement” (hereinafter “PSA”) means the pre-hire collective bargaining agreement between the Contra Costa Community College District and the Contra Costa Building and Construction Trades Council attached to these Contract Documents which establishes the terms and conditions of employment for the Project.

2. Contracts.
   a. The Contractor/Employer shall maintain in a current status, throughout the life of this Contract, the PSA included in these Contract Documents. By accepting the award of this Construction Contract for the Project, whether as Contractor or subcontractor, the Contractor/Employer agrees to be bound by each and every provision of the PSA, and evidence its acceptance prior to the commencement of work by executing the PSA Agreement to be Bound in the form attached to the PSA found in these Contract Documents.

   b. Subcontracts. At the time that any Contractor/Employer enters into a subcontract with any subcontractor providing for the performance of the construction subcontract, the Contractor/Employer shall provide a copy of the PSA to said subcontractor and shall require the subcontractor, as a part of accepting an award of a construction subcontract, to agree in writing to be bound by each and every provision of the PSA, and agree that it will evidence its acceptance prior to the commencement of work by executing the PSA Agreement to be Bound in the form attached to the PSA found in these Contract Documents.

3. Reporting.
a. **PSA Preconstruction Conference.** The Contractor/Employer shall, prior to the commencement of work under this Contract, hold a Preconstruction Conference in accordance with PSA Article 5 PRECONSTRUCTION CONFERENCE which shall be attended by a representative from each Contractor/Employer, the Unions, and the District. The Contractor/Employer shall contact the Contra Costa Building and Construction Trades Council at least two (2) weeks prior to scheduling the Preconstruction Conference so that the Unions can be notified of the date, time, and place of the Conference.
   
i. The Contractor/Employer shall lead the Preconstruction Conference and take minutes of the meeting.
   
ii. The Contractor/Employer shall submit written meeting minutes of the Conference in a form preapproved by the District within five (5) working days. The minutes shall include the names and organizations of each person attending the Conference. The minutes shall also include copies of the Agreements to be Bound required by this Contract and the PSA.

b. **Monthly Reporting.** During each month in which construction work is performed by the Contractor/Employer or by any subcontractor, from Notice to Proceed through Notice of Completion, report the information required below to the District as a monthly administrative Submittal. These reports shall be submitted with each regularly scheduled payment application, or the application will be returned to the Contractor/Employer for resubmittal with the required reports.
   
i. New Agreements to be Bound resulting from new subcontracts, if any, entered into by each Contractor/Employer.
   
ii. Each instance during the reporting period of which a Union is unable to fill a requisition for employees thereby causing the Contractor/Employer to apply Article 8 REFERRAL Clause 8.3, to obtain qualified work persons for the Contract work.
   
iii. A summary of efforts during the reporting period to comply with the goals of Article 10 LOCAL HIRE, including a spreadsheet report of the number of hours worked by all journeymen and by all apprentices on site, and the subset of the number of hours worked by journeymen and by apprentices who are residents of Contra Costa County.
   
iv. A summary of efforts to utilize the Center for Military Recruitment, Assessment and Veterans Employment, in accordance with Article 15 HELMETS TO HARDHATS.
28. **SIGNATURES AND ACKNOWLEDGEMENT**

**Public Agency**, By: _____________________________________________________

[edit]

**Note to Contractor:** (1) Execute acknowledgement form below, and (2) if a corporation, affix Corporate Seal.

**Contractor**, hereby also acknowledging awareness of and compliance with Labor Code S1861 concerning Worker's Compensation Law.

**Contractor:**

By: ___________________________________________ (CORPORATE SEAL)

(Designate Official Capacity – COMPANY NAME)

_____________________________________________________

Print NAME and TITLE

___________________ _____________________
License Number Federal ID Number

**NOTARY PUBLIC**

=================================================================================================

State of California )ss.ACKNOWLEDGEMENT (By Corporation, Partnership or Individual)
County of Contra Costa )

The person(s) signing above for Contractor, known to me in individual and business capacity as stated, personally appeared before me today and acknowledged that he/she/they executed it and that the corporation or partnership named above executed it.

Dated: ________________________________

( NOTARIAL SEAL)

PSA is attached at the end of Section 00600

END OF SECTION 00600
FIRST AMENDMENT TO THE
PROJECT STABILIZATION AGREEMENT
for the
CONTRA COSTA COMMUNITY COLLEGE DISTRICT

Preamble

This is the First Amendment (this “Amendment”) to the Project Stabilization Agreement (“Agreement”) for the Contra Costa Community College District entered into as of the 22nd day of October, 2012, by and between the Contra Costa Community College District ("District") together with contractors and/or subcontractors who became or will become signatory to the Agreement by signing the Agreement Exhibit A, the “Agreement to be Bound”, and the Contra Costa Building & Construction Trades Council (“Council”) and its affiliated local unions that have executed the Agreement (all of whom are referred to collectively as “Unions”).

Recitals

WHEREAS the District, the Council, and the Unions desire to amend the Agreement to reflect certain agreed upon changes as set forth below, with the understanding that all other terms, conditions and Recitals in the Agreement remain valid and in effect; and

WHEREAS Article 2, Section 2.4.10 of the Agreement provides that the District and the Contra Costa Building and Construction Trades Council may mutually agree in writing to amend and extend this Agreement at any time.

NOW THEREFORE, in consideration of the mutual promises and covenants herein contained, the District and the Contra Costa Building and Construction Trades Council, and its affiliated local unions that become signatory to this Amendment, together with the contractors and/or subcontractors who became or will become signatory to the Agreement, do mutually agree to amend the Agreement as noted below with all other terms and conditions to remain unchanged and in effect.

Amendment

Article 1 Section 1.6 is hereby amended and revised to state as follows:

“Project” means any District construction project that has a total minimum estimated construction cost of one million dollars ($1,000,000) or more. The District may, at its discretion, designate other project(s) or contract(s) with a total estimated construction cost of less than one million dollars ($1,000,000) to be covered by this Agreement if the District believes it is in the best interest of the District to do so. Routine maintenance of District properties are not covered by the scope of this Agreement.

Article 2 is hereby amended to include Section 2.4.11 which states as follows:

2.4.11 Pursuant to Section 2.4.10, this Agreement has been reviewed and considered for extension or renewal, and the District and the Contra Costa Building and Construction Trades Council have agreed that the Agreement shall be extended for a term of five (5) years from the original expiration date of the Agreement which is the 22nd day of October 2017. At the close of the extension term, the Agreement shall be reviewed and considered for further extension or renewal, with modifications, if appropriate. Except as amended herein, the Agreement shall continue in full force and effect in accordance with its terms.
Contra Costa Community College District

BY: _______________________________ DATE: 11/9/17
Fred E. Wood
Chancellor

Contra Costa Building and Construction
Trades Council, AFL-CIO

BY: _______________________________ DATE: 10/16/2017
Bill Whitney, Chief Executive Officer
SIGNATURE PAGE
UNIONS

Asbestos Workers Local #16

Boilermakers Local #549

Bricklayers Local #3

Northern California Regional Council of Carpenters for itself and on behalf of its affiliated local unions

Sheet Metal Workers Local #104

Operating Engineers Local #3

District Council #16, Painters and Allied Trades for itself and on behalf of its affiliated local unions

Sprinkler Fitters Local #483

United Association Local #342

Teamsters Local #315

Roofers Local #81

Iron Workers Local #378

Northern California District Council of Laborers for itself and on behalf of its affiliated local unions

Cement Masons Local #300

Electrical Workers Local #302

Plasterers Local #68

United Association Local #159

United Association Local #355
PROJECT STABILIZATION AGREEMENT

for the

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

PREAMBLE

This Project Stabilization Agreement is entered into this 22 day of OCTOBER, 2012 by and between the Contra Costa Community College District (hereinafter, the "District"), together with contractors and/or subcontractors, who shall become signatory to this Agreement by signing the "Agreement To Be Bound" (Exhibit A) (all of whom are referred to herein as "Contractors/Employers"), and the Contra Costa County Building & Construction Trades Council ("Council") and its affiliated local unions that have executed this Agreement (all of whom are referred to collectively as "Unions").

Recitals

WHEREAS, the purpose of this Agreement is to promote efficiency of construction operations during the construction of District Projects and provide for peaceful settlement of labor disputes and grievances without strikes or lockouts, thereby promoting the District's interest and the public's interest in assuring the timely and economical completion of the District's construction Projects; and

WHEREAS, the successful and efficient completion of the District's construction Projects is of the utmost importance to the District and its educational programs and mission; and

WHEREAS, large numbers of workers of various skills will be required in the performance of the construction work, including those to be represented by the Unions affiliated with the Council; and

WHEREAS, it is recognized that District construction Projects require multiple contractors and bargaining units on the job site at the same time over an extended period of time, and that the potential for work disruption is substantial in the absence of a binding commitment to maintain continuity of work; and

WHEREAS, the interests of the general public, the District, the Unions and Contractors/Employers would be best served if the construction work proceeded in an orderly manner without disruption because of strikes, sympathy strikes, work stoppages, picketing, lockouts, slowdowns or other interferences with work; and

WHEREAS, the Contractors/Employers and the Unions desire to mutually establish and stabilize wages, hours and working conditions for the workers employed on District Projects by
the Contractors/Employers and the Unions to the end that a satisfactory, continuous and harmonious relationship will exist among the parties to this Agreement; and

WHEREAS, this Agreement is not intended to replace, interfere, abrogate, diminish or modify existing local or national collective bargaining agreements in effect during the duration of the Program, insofar as a legally binding agreement exists between the Contractor(s)/Employer(s) and the affected Union(s) except to the extent that the provisions of this Agreement are inconsistent with said collective bargaining agreements, in which event, the provisions of this Agreement shall prevail; and

WHEREAS, the contracts for the construction of District Projects will be awarded in accordance with the applicable provisions of the California Public Contract Code; and

WHEREAS, the parties signatory to this Agreement pledge their full good faith and trust to work towards mutually satisfactory completion of all District construction Projects subject to the Agreement.

NOW, THEREFORE, the parties, in consideration of the mutual promises and covenants herein contained, do mutually agree as follows:

ARTICLE 1

DEFINITIONS

1.1 "Agreement" means this Project Stabilization Agreement, plus Exhibit A and Exhibit B.

1.2 "District" means the Contra Costa Community College District and the administrative staff under its Chancellor.

1.3 "Contractor(s)/Employer(s)" means any individual, firm, partnership, corporation or other entity, or any combination thereof, including joint ventures, which is an independent business enterprise and has entered into a contract with the District or any of its contractors or subcontractors of any tier, with respect to construction work on any District Project covered by this Agreement.

1.4 "Master Agreement" means the Master Collective Bargaining Agreement of each craft union signatory hereto, copies of which have been made available by the Council to the District and are on file with the Council and which are incorporated herein by reference and designated the "Schedule A(s)," and are listed in Exhibit B.

1.5 "Project Manager" or "Construction Manager" means any employee or business entity(ies) designated by the District to oversee District Projects subject to this Agreement.

1.6 "Project" means any District construction project that has a total minimum estimated construction cost of two million dollars ($2,000,000) or more. The District may, at its discretion,
designate other project(s) or contract(s) with a total estimated construction cost of less than two million dollars ($2,000,000) to be covered by this Agreement if the District believes it is in the best interest of the District to do so. Routine maintenance of District properties are not covered by the scope of this Agreement.

1.7. "Union" or "Unions" means the Contra Costa Building and Construction Trades Council, AFL-CIO and its affiliated local unions that have executed this Agreement.

ARTICLE 2

SCOPE OF AGREEMENT AND TERM

2.1. This Agreement shall apply to all on-site demolition, construction, alteration, painting or repair of buildings, structures and other works and related activities on any Project covered by this Agreement that is within the craft jurisdiction of one of the Unions and that is directly or indirectly part of the Project, including, without limitation, pipelines (including those in linear corridors built to serve the Project), pumps, pump stations, start-up, site preparation, on-site survey work, soils and material inspection and testing, including x-ray technicians, and all on-site fabrication work provided such work is within the fabrication provision of a local Master Agreement or national agreement of one of the Unions. On-site fabrication work includes work done for the Project in temporary yards or areas near the Project, and at the site of any batch plant constructed solely to supply materials to the Project. This Agreement also covers all off-site work, including fabrication, that is traditionally performed by any of the Unions that are directly or indirectly part of the Project, provided such work is covered by a provision of a local Master Agreement or a local addendum to a national agreement of the applicable Union(s) including delivery and off-haul work to the full extent of the law.

2.2. This Agreement shall govern the award of all construction contracts on all District Projects covered by this Agreement. The District has the absolute right to combine, consolidate, add, or cancel covered Project(s) or portions of covered Project(s). Once a construction Project is completed, it is no longer covered by this Agreement. For the purposes of this Agreement, a construction Project shall be considered completed upon filing of a Notice of Completion.

2.3. All labor disputes involving the application or interpretation of the collective bargaining agreement to which a signatory Contractor/Employer and a signatory Union are parties shall be resolved pursuant to the resolution procedures of the collective bargaining agreement. All disputes relating to the interpretation or application of this Agreement shall be subject to resolution pursuant to the grievance arbitration procedure set forth herein.

2.4. Exclusions:

2.4.1. This Agreement shall be limited to construction work on covered Projects and is not intended to, and shall not, govern any construction work performed at the District at any time prior to the effective date, or after the expiration or termination, of this Agreement.
2.4.2. This Agreement is not intended to, and shall not affect or govern the award of public works contracts by the District which are outside the approved scope of the Projects.

2.4.3. This Agreement is not intended to, and shall not affect the operation or maintenance of the District.

2.4.4. This Agreement shall not apply to a Contractor's/Employer's executives, managerial employees, engineering employees, supervisors (except those covered by existing building and construction trades collective bargaining agreements), and office and clerical employees.

2.4.5. This Agreement shall not apply to employees of the District.

2.4.6. This Agreement shall not apply to contracts awarded pursuant to any emergency public works project(s).

2.4.7 The District shall retain the right at all times to perform and/or subcontract small, incidental portions of related work on the Project site not contracted by the construction contract documents to the signatory Contractor(s) bound to this Agreement.

2.4.8. No provisions negotiated in any Master Agreement solely to apply to work covered by this Project Stabilization Agreement shall apply if such provisions are less favorable to the Contractor for work covered by this Project Stabilization Agreement than those provisions uniformly required of contractors for construction work normally covered by those Master Labor Agreements.

2.4.9 It is the legal obligation of the District to obtain the most competitive bids while maintaining the conditions of the Agreement. To ensure that a competitive bid is received from a range of general contractors, the Contra Costa Building and Construction Trades Council shall assist the District in soliciting interested parties in bidding on the Project(s). Additionally, the District recognizes that multiple subcontractor quotations of bids ensure the most competitive overall bid. The Contra Costa Building and Construction Trades Council shall assist the District in encouraging and soliciting local and other subcontractors in bidding to interested general contractors. In the event the Project bids over the estimated construction cost of the Project, the District reserves the right to request a list of all subcontractors which bid to the two lowest general contractors to verify that adequate competitive bidding was conducted. Additionally, if the project bids are over the estimated construction cost and fewer than three (3) general contractors bid on the Project(s), the District reserves the right, without reservation, to reject all bids and re-bid the Project.

2.4.10 This Agreement shall become effective on the day it is signed by the District, the Contra Costa Building and Construction Trades Council, AFL-CIO, and its affiliated local Unions and shall continue in full force and effect for a period of five (5) years, at which time this Agreement will be reviewed and considered for extension or renewal, with modifications, if appropriate. The terms of this Agreement shall continue to apply to
those Projects subject to this Agreement until construction is completed. The District and
the Contra Costa Building and Construction Trades Council may mutually agree in
writing to amend, extend or terminate this Agreement at any time. Should either the
District or the Contra Costa Building and Construction Trades Council, AFL-CIO, wish to
unilaterally terminate this Agreement prior to its expiration, that party must provide
written notice to the other party and, if a mutually acceptable resolution cannot be
reached, shall submit the request to a neutral arbitrator selected from the following list of
arbitrators, through a striking procedure, with a coin toss determining the order of
striking, for a final and binding determination whether just cause exists for early
termination of the Agreement because it is no longer serving the Purposes, as set forth
in the Recitals, herein:

Thomas Angelo
William Riker
Barry Winograd
Jerilou Cossack
William Engler

ARTICLE 3

EFFECT OF AGREEMENT

3.1. By executing this Agreement, the Unions and the District agree to be bound by each and
all of the provisions of the Agreement.

3.2. By accepting the award of a construction contract for a Project, whether as contractor or
subcontractor, the Contractor/Employer agrees to be bound by each and every provision of the
Agreement and agrees that it will evidence its acceptance prior to the commencement of work
by executing the Agreement to be Bound in the form attached hereto as Exhibit A.

3.3. At the time that any Contractor/Employer enters into a subcontract with any
subcontractor providing for the performance of a Construction Contract, the
Contractor/Employer shall provide a copy of this Agreement to said subcontractor and shall
require the subcontractor as a part of accepting an award of a construction subcontract to agree
in writing to be bound by each and every provision of this Agreement prior to the
commencement of work. If a Contractor/Employer requires a subcontractor to agree in writing to
comply with the terms of this Agreement as a condition of awarding work to the subcontractor,
the Contractor/Employer shall not be liable in any way for the subcontractor’s failure to pay the
wages and benefits required by this Agreement except as required by the provisions of the
California Labor Code.

3.4. Except as enumerated in this Agreement, all other terms and conditions of employment
described in the Master Agreement of the Union having traditional and customary jurisdiction
over the work shall apply. The provisions of this Agreement shall take precedence over
conflicting provisions of any applicable Master Agreement, or any other national, area or local
collective bargaining agreement, except that all work performed under the NTL Articles of
Agreement, the National Stack/Chimney Agreement and the National Cooling Tower Agreement; all instrument calibration work and loop checking Covered Work shall be performed under the terms of the UA/IBEW Joint National Agreement for Instrument and Control Systems Technicians, and work within the craft jurisdiction of the Elevator Constructors will be performed under the terms of the National Agreements of the International Union of Elevator Constructors; provided that Articles 4 and 13 of this Agreement shall apply to all Covered Work. In the absence of a conflict, the provisions of the applicable Master Agreements shall govern.

3.5.  This Agreement shall only be binding on the signatory parties hereto and shall not apply to the parents, affiliates, subsidiaries or other ventures of any such party.

3.6.  This Agreement shall not be effective unless and until the District, the Contra Costa Building and Construction Trades Council AFL-CIO and all the Unions listed on the signature page have signed and dated this Agreement.

ARTICLE 4

WORK STOPPAGES, STRIKES, SYMPATHY STRIKES AND LOCKOUTS

4.1.  The Unions, District and Contractor(s)/Employer(s) agree that for the duration of the Program:

4.1.1.  There shall be no strikes, sympathy strikes, work stoppages, picketing, handbilling or otherwise advising the public that a labor dispute exists, or slowdowns of any kind, for any reason, by the Unions or employees employed on a covered Project, at the job site of the Project or at any other facility of the District because of a dispute on a covered Project or with a Contractor/Employer on the Project.  It shall not be considered a violation of this provision for a Union to withhold labor (but not picket) from any Contractor/Employer who fails to make its timely payment of Trust Fund contributions or fails to meet its weekly payroll.  The affected Union shall give 72-hour written notice to the District prior to withholding labor due to a Contractor’s failure to make timely payment of Trust Fund contributions or payroll. Although disputes arising between the Unions and Contractor(s)/Employer(s) on other projects are not governed by this Agreement, a Union may not take any action against Contractor(s)/Employer(s) on District property and/or on a District Project because of a dispute between the Unions and Contractor(s)/Employer(s) on other projects.

4.1.1.1  If the arbitrator determines, in accordance with this Article, a work stoppage has occurred, the respondent Union(s) shall, within eight (8) hours of receipt of the decision, direct all of the employees they represent on the Project to immediately return to work. If the craft(s) involved do not return to work by the beginning of the next regularly scheduled shift following such eight (8) hour period after receipt of the arbitrator’s decision, and the respondent Union(s) have not complied with their obligations to immediately instruct, order and use their best efforts to cause a cessation of the violation and return the employees they
represent to work, then the non-complying respondent Union(s) shall each pay a sum as liquidated damages to the District, and each will pay an additional sum per shift, as set forth in 4.1.1.3 below, for each shift thereafter on which the craft(s) have not returned to work.

4.1.1.2 If the arbitrator determines in accordance with this Article that a lock-out has occurred, the respondent Contractor(s) shall, within eight (8) hours after receipt of the decision, return all the affected employees to work on the Project, or otherwise correct the violation found by the arbitrator. If the respondent Contractor(s) do not take such action by the beginning of the next regularly scheduled shift following the eight (8) hour period, each non-complying respondent Contractor shall pay or give as liquidated damages, to the affected Union(s) (to be apportioned among the affected employees and the benefit funds to which contributions are made on their behalf, as designated by the arbitrator) and each shall pay an additional sum per shift, as set forth in 4.1.1.3 below, for each shift thereafter in which compliance by the respondent Contractor(s) have not been completed.

4.1.1.3 The arbitrator shall retain jurisdiction to determine compliance with this Section and to establish the appropriate sum of liquidated damages, which shall be not less than One Thousand Dollars ($1,000.00), nor more than Five Thousand Dollars ($5,000.00) per shift for each non-complying entity.

4.1.2. As to employees employed on a covered Project, there shall be no lockout of any kind by a Contractor/Employer subject to the Agreement.

4.1.3. If a Master Agreement between a Contractor/Employer and the Union expires before the Contractor/Employer completes the performance of a Construction Contract and the Union or Contractor/Employer gives notice of demands for a new or modified Master Agreement, the Union agrees that it will not strike the Contractor/Employer on said contract for work covered under this Agreement, and the Union and the Contractor/Employer agree that the expired Master Agreement shall continue in full force and effect for work covered under this Agreement until a new or modified Master Agreement is reached between the Union and Contractor/Employer.

4.2. When a remedy is sought for an alleged breach of this Article, any party to this Agreement shall institute the following procedure, prior to any other action at law or equity.

4.2.1. A party invoking this procedure shall notify Thomas Angelo, as the permanent arbitrator, or Robert Hirsch, as the alternate, under this procedure. In the event that the permanent arbitrator is unavailable at any time, the alternate will be contacted. If neither is available, then a selection shall be made from the list of arbitrators in Article 12, Section 12.2. Notice to the arbitrator shall be by the most expeditious means available, with notices by facsimile or telephone to the party alleged to be in violation and to the Contra Costa Building and Construction Trades Council and involved Union if a Union is alleged to be in violation.
4.2.2. Upon receipt of said notice, the District will contact the designated arbitrator named above or his alternate who will attempt to convene a hearing within twenty-four (24) hours if it is contended that the violation still exists.

4.2.3. The arbitrator shall notify the parties by facsimile or telephone of the place and time for the hearing. Said hearing shall be completed in one session, which, with appropriate recesses at the arbitrator's discretion, shall not exceed twenty-four (24) hours unless otherwise agreed upon by all parties. A failure of any party to attend said hearings shall not delay the hearing of evidence or the issuance of any award by the arbitrator.

Thomas Angelo's postal address, phone number, fax number and e-mail address are:

Thomas Angelo
PO Box 1937
Mill Valley CA 94943
Phone: (415) 381-1701
Fax: (415) 380-9792
tangelomv@gmail.com

Robert Hirsch postal address, phone number, and e-mail address are:

Robert Hirsch
PO Box 170428
San Francisco, CA 94117
Phone: 415-362-9999
Rmhirsch@gmail.com

4.2.4. The sole issue at the hearing shall be whether or not a violation of Article 4, Section 4.1 of the Agreement has occurred. The arbitrator shall have no authority to consider any matter of justification, explanation or mitigation of such violation or to award damages, which issue is reserved for court proceedings, if any. The award shall be issued in writing within three (3) hours after the close of the hearing, and may be issued without a written opinion. If any party desires a written opinion, one shall be issued within fifteen (15) days, but its issuance shall not delay compliance with, or enforcement of, the award. The arbitrator may order cessation of the violation of this Article and other appropriate relief and such award shall be served on all parties by hand or registered mail upon issuance.

4.2.5. Such award may be enforced by any Court of competent jurisdiction upon the filing of this Agreement and all other relevant documents referred to above in the following manner. Written notice of the filing of such enforcement proceedings shall be given to the other party. In the proceeding to obtain a temporary order enforcing the arbitrator's award as issued under Section 4.2.4 of this Article, all parties waive the right
to a hearing and agree that such proceedings may be ex parte. Such agreement does not waive any party's right to participate in a hearing for a final order or enforcement. The Court's order or orders enforcing the arbitrator's award shall be served on all parties by hand or delivered by certified mail.

4.2.6. Any rights created by statute or law governing arbitration proceedings inconsistent with the above procedure or which interfere with compliance are waived by the parties.

4.2.7. The fees and expenses of the arbitrator shall be divided equally between the parties to the arbitration.

4.2.8. The parties to this Agreement agree that the labor organizations have not waived their legal rights to undertake otherwise lawful activity with regard to any dispute or disputes which they may have regarding non-Project construction work and operations; provided, however, that any such activities by the signatory Unions shall not disrupt or interfere in any way with any work done at any District site. Recognizing the above and, in order to carry out the principles of this Agreement, the parties agree that should a signatory Union have a dispute with regard to non-covered work on or adjacent to any District site, the signatory Union will notify the Contra Costa Building and Construction Trades Council and shall not undertake on or adjacent to the property, any public activity regarding the dispute. Representatives of the involved Union and the Council shall meet with the representatives of the District to discuss and review the valid, legal manner and means by which the signatory Union may undertake its activities with regard to this dispute (giving due consideration in such discussions and review to the traditional concerns for the ongoing operations of the Project and to the importance of the continuity of the work covered by the Master Agreement), and develop a program which allows the signatory Union to exercise its legal rights but at the same time eliminates any possible disruptive effect on the ongoing Project construction work.

4.2.9. Should any Union or the District (or its Project Manager/Project Contractors/Employers) become aware of a possible or actual labor dispute involving non-Project construction work or operations and involving non-signatory unions which may result in public activity on or about any District site by such non-signatory unions, the representative of each will jointly meet to discuss such activity and to work together, using their best efforts, to avoid having such activity adversely impact or otherwise delay or interfere with ongoing Project construction work.

4.2.10. To the extent any provision in this Article 4 conflicts with the dispute resolution provisions of Public Contract Code section 20104, et seq, this Article 4 shall be null and void.
ARTICLE 5

PRECONSTRUCTION CONFERENCE

5.1. A preconstruction conference shall be held prior to the commencement of each construction Project. Such conference shall be attended by a representative each from the participating Contractor(s)/Employer(s) and Union(s) and the Project Manager.

ARTICLE 6

NO DISCRIMINATION

6.1. The Contractor(s)/Employer(s) and Unions agree not to engage in any form of discrimination on the ground or because of; race, color, creed, national origin, ancestry, age, sex, sexual orientation, disability or Acquired Immune Deficiency Syndrome or AIDS Related Condition (AIDS/ARC), or union status against any employee, or applicant for employment, on the Program.

ARTICLE 7

UNION SECURITY

7.1. The Contractor(s)/Employer(s) recognize the Union(s) as the sole bargaining representative of all craft employees working within the scope of this Agreement.

7.2. No employee covered by this Agreement is required to join any Union as a condition of being first employed on the Project.

7.3. All employees working on the Project shall be governed by the applicable Union security clause of the applicable craft's "Schedule A" Agreement. Employees hired by the Contractor(s)/Employer(s) shall, as a condition of employment, be responsible for the payment of the applicable monthly working dues and any associated fees uniformly required for union membership in the local Union which is signatory to this Agreement. Further, there is nothing in this Agreement that would prevent non-union employees from joining the local Union.

7.4. Authorized representatives of the Unions shall have access to the Projects whenever work covered by this Agreement is being, has been, or will be performed on the Projects, provided it is not disruptive to the work on the Projects or the operation of the District.
ARTICLE 8

REFERRAL

8.1. Contractor(s)/Employer(s) performing construction work on covered Projects shall, in filling craft job requirements be bound by and utilize the registration facilities and referral systems established or authorized by the signatory Unions when such procedures are not in violation of Federal law. The Contractor(s)/Employer(s) shall have the right to reject any applicant referred by the Union(s), in accordance with the applicable Master Agreement.

8.2. The Contractor(s)/Employer(s) shall have the unqualified right to select and hire directly all supervisors above the level of General Foreman it considers necessary and desirable, without such persons being referred by the Union(s). The selection of craft foremen and general foremen shall be entirely the responsibility of the Contractor(s). Foremen and general foremen shall take orders from the designated Contractor(s) representatives.

8.3. In the event that referral facilities maintained by the Unions are unable to fill the requisition of a Contractor/Employer for employees within a forty-eight (48) hour period (Saturday, Sundays and holidays excluded) after such requisition is made by the Contractor/Employer, the Contractor/Employer shall be free to obtain work persons from any source.

8.4. Unions will exert their utmost efforts to recruit sufficient numbers of skilled craft persons to fulfill the requirements of the Contractor(s)/Employer(s). The parties to this Agreement support the development of increased numbers of skilled construction workers from graduates of District schools and residents of Contra Costa County and the surrounding East Bay Area to meet the needs of District Projects and the requirements of the industry generally. Toward that end, the Unions agree to encourage the referral and utilization, to the extent permitted by law and the hiring hall procedures, of qualified graduates of District schools, Contra Costa residents and residents of the East Bay Area as journeymen and apprentices to covered Projects and entrance into such apprenticeship and training programs as may be operated by the Unions.

8.5. Recognizing the special needs of District Projects, the Unions shall consider a Contractor(s)/Employer(s) request to transfer key employees to work on a covered Project in a manner consistent with the Union's referral procedures.

ARTICLE 9

BENEFITS

9.1. All Contractor/Employers agree to pay contributions to the vacation, pension and other form of deferred compensation plan, apprenticeship, and health benefit funds established in the applicable Schedule A for each hour worked on the Project in amounts no less than those designated in the Department of Industrial Relations Wage Determination of the applicable craft.
9.2. The Contractor(s)/Employer(s) shall not be required to pay contributions to any other trust funds that are not contained in the published prevailing wage determination to satisfy their obligation under this Article except those Contractor(s)/Employer(s) who are signatory to the Master Agreements with the respective trades shall continue to pay all trust fund contributions as outlined in such Master Agreements.

9.3. By signing this Agreement, the Contractor(s)/Employer(s) adopt and agree to be bound by the written terms of the legally established Trust Agreements as described in Section 9.1 above specifying the detailed basis on which payments are to be made into, and benefits paid out of, such Trust Funds.

9.4. Wages, Hours, Terms and Conditions of Employment: The wages, hours and other terms and conditions of employment on a Project shall be governed by the Master Agreement of the respective crafts, copies of which shall be on file with the District, to the extent the prevailing wage determination is not inconsistent with the applicable Department of Industrial Relations Prevailing Wage Determinations which shall establish minimum wages. Where a subject is covered by the Master Agreement and not covered by a Wage Determination or this Agreement, the Master Agreement will prevail. When a subject is covered by both the Master Agreement and this Agreement, to the extent there is any inconsistency, this Agreement will prevail.

ARTICLE 10
LOCAL HIRE

10.1. It is an objective of the parties that not less than 25 percent (25%) of all hours worked by journeyman and apprentices on the Project, on a craft by craft basis, be worked by residents of the area served by the Contra Costa Community College District. The Unions will exert their utmost efforts to recruit sufficient numbers of skilled craft persons to fulfill the requirements of the Contractor(s)/Employer(s). The parties to this Agreement support the development of increased numbers of skilled construction workers from the area served by the District. To the extent allowed by law, and consistent with the local Union's hiring hall provisions, and as long as they possess the requisite skills and qualifications, residents of the area served by the District, including journeyman and apprentices, shall be referred for Project work covered by this Agreement.

ARTICLE 11
COMPLIANCE

11.1. It shall be the responsibility of the Contractor(s)/Employer(s) and Unions to investigate and monitor compliance with the provisions of the Agreement contained in Article 9. Nothing in this agreement shall be construed to interfere with or supersede the usual and customary legal remedies available to the Unions and/or employee benefit Trust Funds to collect delinquent Trust Fund contributions from Employers on the Project. The District shall monitor and enforce compliance with the prevailing wage requirements of the State and Contractor(s)/Employer(s) compliance with this Agreement if the District operates a labor compliance program ("LCP") on the Covered Project and if that LCP requires the District to monitor and enforce this compliance.
ARTICLE 12

GRIEVANCE ARBITRATION PROCEDURE

12.1. The parties understand and agree that questions between or among parties signatory to a Master Agreement arising out of or involving the interpretation of a Master Agreement shall be resolved under the grievance procedure provided in that Master Agreement. The parties further understand and agree that in the event any dispute arises out of the meaning, interpretation or application of the provisions of this Agreement, such dispute shall be settled by means of the procedures set out herein. No grievance filed under this Grievance Arbitration Procedure shall be recognized unless the grieving party (Union on its own behalf, or on behalf of an employee whom it represents, or a Contractor/Employer on its own behalf) provides notice in writing to the signatory party with whom it has a dispute within five (5) days after becoming aware of the dispute but in no event more than thirty (30) days after it reasonably should have become aware of the event giving rise to the dispute. The time limits in this Section 12.1 may be extended by mutual written agreement of the parties.

12.2. Grievances shall be settled according to the following procedures:

Step 1: Within five (5) business days after the receipt of the written notice of the grievance, the Business Representative of the involved local Union or his/her designee, or the representative of the employee, and the representative of the involved Contractor/Employer shall confer and attempt to resolve the grievance.

Step 2: In the event that the representatives are unable to resolve the dispute within the five (5) business days after its referral to Step 1, the International Union Representative and the Contractor involved shall meet within seven (7) working days of the referral of the dispute to this second step to arrive at a satisfactory settlement thereof. Meeting minutes shall be kept by the Contractor. In the event that these representatives are unable to resolve the dispute after its referral to Step 2, either involved party may submit it within three (3) business days to the Grievance Committee, which shall meet within five (5) business days after such referral (or such longer time as is mutually agreed upon by all representatives on the Grievance Committee), to confer in an attempt to resolve the grievance. The Grievance Committee shall be comprised of

- two (2) representatives of the District; and
- two (2) representatives of the Contra Costa Building & Construction Trades Council.

If the dispute is not resolved within such time (five (5) business days after its referral or such longer time as mutually agreed upon) it may be referred within five (5) business days by either party to Step 3.

Step 3: Within five (5) business days after referral of a dispute to Step 3, the representatives shall choose a mutually agreed upon arbitrator for final and binding
arbitration. The parties agree that if the permanent arbitrator or his alternate is not available, an arbitrator shall be selected by the alternate striking method from the list of five (5) below:

1. Barry Winograd
2. Thomas Angelo
3. Robert Hirsch
4. William Riker
5. Joseph Grodin

The decision of the Arbitrator shall be binding on all parties. The Arbitrator shall have no authority to change, amend, add to, or detract from, any of the provisions of the Agreement. The expense of the Arbitrator shall be divided equally between the parties to the arbitration.

The Arbitrator shall arrange for a hearing on the earliest available date from the date of his/her selection. A decision shall be given to the parties within five (5) calendar days after completion of the hearing unless such time is extended by mutual agreement. A written opinion may be requested by a party from the presiding Arbitrator.

The time limits specified in any step of the Grievance Procedure set forth in Section 12.2 may be extended by mutual agreement of the parties initiated by the written request of one party to the other, at the appropriate step of the Grievance Procedure. However, failure to process a grievance, or failure to respond in writing within the time limits provided above, without an agreed upon extension of time, shall be deemed a waiver of such grievance without prejudice, or without precedent to the processing of and/or resolution of like or similar grievances or disputes.

In order to encourage the resolution of disputes and grievances at Steps 1 and 2 of this Grievance Procedure, the parties agree that such settlements shall not be precedent setting.

ARTICLE 13

JURISDICTIONAL DISPUTES

13.1. The assignment of Covered Work will be solely the responsibility of the Employer performing the work involved; and such work assignments will be in accordance with the Plan for the Settlement of Jurisdictional Disputes in the Construction Industry (the "Plan") or any successor Plan.

13.2. All jurisdictional disputes on this Project between or among the Building and Construction Trades Unions and their employers, parties to this Agreement, shall be settled and
adjusted according to the present Plan established by the Building and Construction Trades Department or any other plan or method of procedure that may be adopted in the future by the Building and Construction Trades Department. Decisions rendered shall be final, binding and conclusive on the Employers and Unions parties to this Agreement.

13.2.1. For the convenience of the parties, and in recognition of the expense of travel between Northern California and Washington, DC, at the request of any party to a jurisdictional dispute under this Agreement an Arbitrator shall be chosen by the procedures specified in Article V, Section 5, of the Plan from a list composed of John Kagel, Thomas Angelo, Robert Hirsch, and Thomas Pagan, and the Arbitrator's hearing on the dispute shall be held at the offices of the applicable Building and Construction Trades Council. All other procedures shall be as specified in the Plan.

13.3. All jurisdictional disputes shall be resolved without the occurrence of any strike, work stoppage, or slow-down of any nature, and the Employer's assignment shall be adhered to until the dispute is resolved. Individuals violating this Section shall be subject to immediate discharge.

13.4. Each Employer will conduct a pre-job conference with the Local Council prior to commencing work. Primary Employer will be advised in advance of all such conferences and may participate if they wish. Pre-job conferences for different Employers may be held together.

ARTICLE 14

APPRENTICES

14.1. Recognizing the need to maintain continuing support of programs designed to develop adequate numbers of competent workers in the construction industry, the Contractor(s)/Employer(s) shall employ apprentices of a State-approved Apprenticeship Program in the respective crafts to perform such work as is within their capabilities and which is customarily performed by the craft in which they are indentured.

14.2. The apprentice ratios will be in compliance with the applicable provisions of the California Labor Code and Prevailing Wage Rate Determination.

14.3. There shall be no restrictions on the utilization of apprentices in performing the work of their craft provided they are properly supervised.

ARTICLE 15

HELMETS TO HARDCATS

15.1. The Contractors/Employers and Unions recognize a desire to facilitate the entry into the building and construction trades of veterans and members of the National Guard and Reserves who are interested in careers in the building and construction industry. The
Contractors/Employers and Unions agree to utilize the services of the Center for Military Recruitment, Assessment and Veterans Employment (hereinafter "Center"), a joint Labor-Management Cooperation Trust Fund, established under the authority of Section 6(b) of the Labor-Management Cooperation Act of 1978, 29 U.S.C. Section 175(a), and Section 302(c)(9) of the Labor-Management Relations Act, 29 U.S.C. Section 186(c)(9), and a charitable tax exempt organization under Section 501(c)(3) of the Internal Revenue Code, and the Center's "Helmets to Hardhats" program to serve as a resource for preliminary orientation, assessment of construction aptitude, referral to apprenticeship programs or hiring halls, counseling and mentoring, support network, employment opportunities and other needs as identified by the parties.

15.2. The Unions and Contactors/Employers agree to coordinate with the Center to create and maintain an integrated database of veterans and members of the National Guard and Reserves interested in working on this Project and of apprenticeship and employment opportunities for this Project. To the extent permitted by law, the Contactors/Employers and Unions will give credit to such veterans and members of the National Guard and Reserves for bona fide, provable past experience.

15.3. In recognition of the work of the Center and the value it offers to the Project, Contactors/Employers performing work on the Project, on a voluntary basis, may elect to contribute to the Center the amount of one cent ($0.01) per hour for each hour worked by each individual employee covered by this Agreement. Any such payments shall be forwarded monthly to the Center in a form and manner to be determined by the Center's Trustees.

15.4. The Center shall function in accordance with, and as provided in the Agreement and Declaration of Trust creating the fund, and any amendments thereto, and any other of its governing documents. Each Contractor(s)/Employer(s) electing to contribute to the Center approves and consents to the appointment of the Trustees designated pursuant to the Trust Agreement establishing the Center and hereby adopts and agrees to be bound by the terms and provisions of the Trust Agreement.

ARTICLE 16

MANAGEMENT RIGHTS

16.1. The Contractor(s)/Employer(s) shall retain full and exclusive authority for the management of their operations, including the right to direct their work force in their sole discretion. No rules, customs or practices shall be permitted or observed which limit or restrict production, or limit or restrict the working efforts of employees except that lawful manning provisions in the Master Agreement shall be recognized.

16.2. Except as provided in Section 2.1, there shall be no limitation or restriction upon the choice of materials or upon the full use and installation of equipment, machinery, package units, factory pre-cast prefabricated or preassembled materials, tools or other labor saving devices. The on-site installation or application of all items shall be performed by the craft having jurisdiction over such work; provided, however, it is recognized that installation of specialty items which may be furnished by the owner of the Project or a Contractor shall be performed by
construction persons employed under this Agreement who may be directed by other personnel in a supervisory role, provided, however, in limited circumstances requiring special knowledge of the particular item(s), may be performed by construction persons of the vendor or other companies where necessary to protect a manufacturer’s warranty. In such instances all provisions of this Agreement shall apply. The issue of whether it is necessary to use construction persons of the vendor or other companies to protect the manufacturer’s warranty shall be subject to the grievance and arbitration clause of this Agreement.

ARTICLE 17

SAVINGS CLAUSE

17.1 The parties agree that in the event any article, provision, clause, sentence or word of the Agreement is determined to be illegal or void as being in contravention of any applicable law, by a court of competent jurisdiction such as the Department of Industrial Relations, the Division of Apprenticeship Standards, and other applicable labor related governmental agencies the remainder of the Agreement shall remain in full force and effect. The parties further agree that if any article, provision, clause, sentence or word of the Agreement is determined to be illegal or void, by a court of competent jurisdiction or other labor related governmental authorities, the parties shall substitute, by mutual agreement, in its place and stead, an article, provision, clause, sentence or word which will meet the objections to its validity and which will be in accordance with the intent and purpose of the article, provision, clause, sentence or word in question.

ARTICLE 18

MISCELLANEOUS PROVISIONS

18.1 Counterparts: This Agreement may be executed in counterparts, such that original signatures may appear on separate pages, and when bound together all necessary signatures shall constitute an original. Facsimile signature pages transmitted to other parties to this Agreement shall be deemed equivalent to original signature.

18.2 Warranty of Authority: Each of the persons signing this Agreement represents and warrants that such person has been duly authorized to sign this Agreement on behalf of the party indicated, and each of the parties by signing this Agreement warrants and represents that such party is legally authorized and entitled to enter into this Agreement.

18.3 Ratification by Governing Board: This Agreement shall not be binding on the District until it is approved by the Contra Costa Community College District Governing Board.

18.4 The Agreement shall be included as a condition of the award of all Construction Contracts that are a part of the PSA Program.

18.5 The parties shall establish and implement reasonable substance abuse testing procedures and regulations, which may include prehire, reasonable cause, random and post-
accident testing, to the extent permitted and/or required by Federal and State Law. Should the District administrator for the PSA approve an established program to which signatory Unions are currently a party, such program may become the Project-wide substance abuse testing program, after consultation with the Unions. Until there is such a Project-site substance abuse testing procedure negotiated by the District administrator and the Unions for the PSA, such substance abuse testing procedures as are contained in the Schedule A’s shall be applicable to work on the Project, pursuant to their terms.

Contra Costa Community College District

BY: Helen Benjamin
Chancellor

DATE: 10-22-12

Contra Costa Building & Construction Trades Council AFL-CIO (Council)

BY: Greg Feere
Secretary-Treasurer
Business Manager

Exhibit A
Agreement to Be Bound

Project Stabilization Agreement

The undersigned, as a Contractor on the Contra Costa Community College Project Stabilization Agreement "Project", subject to the Project Stabilization Agreement "Agreement", for and in consideration of the award to it of a contract to perform work on said Project, and in further consideration of the promises made in the Agreement and all attachments, a copy of which was received and is acknowledged, hereby:

1. Accepts and agrees to be bound by the terms and conditions of the Agreement together with any and all amendments and supplements now existing or which are later made thereto only for the duration and scope of the Contractor's work on the Project.

2. The Contractor agrees to be bound by the legally established trust agreements designated in local master collective bargaining agreements. The Contractor authorizes the parties to such local trust agreements to appoint trustees and successor trustee to administer the trust funds and hereby ratifies and accepts the trustees so appointed as if made by the Contractor.

3. Certifies that it has no commitments or agreements which would preclude its full and complete compliance with the terms and conditions of said Agreement.

4. Agrees to secure from any Contractor(s) (as defined in said Agreement) which are or become a subcontractor (of any tier) to it a duly executed Agreement to be Bound in a form identical to this document.

___________________________________   ___________________________
Signature of (Sub)Contractor     Date

___________________________________________ ___________________________
(Authorized Officer & Title)     Contractor's State License #
Exhibit B
List of "Schedule A" Agreements:
Collective Bargaining Agreements of each craft signatory to this Project Stabilization Agreement

1. Asbestos Workers Local 16
2. Boilermakers Local 549
3. Bricklayers Local 3
4. Northern California Regional Council of Carpenters for and on Behalf of Their Affiliated Crafts
5. Sheet Metal Workers Local 104
6. Operating Engineers Local 3
7. Painters District Council 16
8. Sprinkler Fitters Local 483
9. United Association Local 342
10. Teamsters Local 315
11. Hod Carriers Local 166
12. Roofers Local 81
13. Iron Workers Local 378
14. Laborers Local Union 324
15. Laborers Local Union 67
16. Cement Masons Local 300
17. Electrical Workers Local 302
18. Plasterers Local 66
19. United Association Local 159
20. United Association Local 355
21. Elevator Constructors Local 8
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PSA for the Contra Costa Community College District 2012
SECTION 00650
NOTICE TO PROCEED

Date: ______________________

TO: ____________________________________________________________

ADDRESS: ______________________________________________________

PROJECT: ________________________________________________________

You are notified that the Contract Time under the above contract will commence to run on. By that date, you are to start performing your obligations under the Contract Documents.

In accordance with Section 00600, Construction Agreement, the date of Substantial Completion is ____________, and the date for Final Completion is ________________.

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

By: ______________________________________________
    Ines Zildzic

Title: Vice Chancellor, Facilities Planning and Construction

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# SECTION 00700

## GENERAL CONDITIONS

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ARTICLE 1
GENERAL CONDITIONS

1.1 BASIC DEFINITIONS

- Action of the Governing Board is a vote of a majority of the District’s governing board.

- Approval for a Contract, Agreement, or Change Order means written authorization through action of the governing board unless specific delegation of approval authority is delegated to a District representative.

- Approved. The term “approved,” when used to convey Architect’s action on Contractor’s submittals, applications, and requests, is limited to Architect’s duties and responsibilities as stated in the Conditions of the Contract.

- Architect means the architect, engineer, or other design professional engaged by the District to design and perform general observation of the work of construction and interpret the drawings and specifications for the Project.

- As shown, as indicated, as detailed refer to drawings accompanying this specification.

- Bid/Bidders. The term Bid and Proposal have the same meaning, and the same is true for Bidders and Proposers.

- Contract or Agreement. When the terms are used in these General Conditions shall be references to the Contract Documents as defined herein.

- Contract Price. The price stated in the Construction Agreement including authorized adjustments, the total amount payable by the District to the Contractor for performance of the Work. The Contract Price is also referred sometimes to as the Contract Sum or Contract Amount.

- Contract Time. Contract Time means the number of consecutive calendar days specified in the contract immediately after the date to commence work issued by the District in the Notice to Proceed, and includes both the time allowed for the work required to achieve Substantial Completion and the time allowed to complete the Remaining Work from Substantial Completion to Final Completion.

- Contractor. Whenever the term “Contractor” is used in the Contract or elsewhere in the Contract Documents, it refers to a person or entity that has an agreement
directly with the District to perform any of the work for the Project. The term Contractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Contractor or his authorized representative. The term Contractor does not include any contractors under separate and direct contract with the District. A Subcontractor is a person or entity that has a direct or indirect contract with the Contractor to perform any of the Work at the site.

- **Contractor’s Construction Schedule.** The document prepared by the Contractor, which details the events of construction and establishes completion dates for the various stages of the Work and the entire project. The Contractor’s Construction Schedule is also referred to as the Baseline CPM Schedule, Initial CPM Schedule or Baseline CPM Schedule update.

1.1.12 **The Contract Documents.** The Contract Documents consist of the Agreement between District and Contractor (hereinafter the Agreement or Contract), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, addenda issued prior to bid, instructions to bidders, notice to bidders, and the requirements contained in the Bid Documents, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is a written amendment to the Contract signed by parties, a Change Order, a Construction Change Directive, or a written order for a minor change in the Work issued by the Architect. The Contract Documents collectively form the Contract. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a written Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind between the Architect and Contractor, between the District and any Subcontractor or Sub-subcontractor, or between any persons or entities other than the District and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect’s duties.

1.1.13 **Contractor, District, and Architect** are those mentioned as such in the Agreement. They are treated throughout the Contract Documents as if they are of singular number and neuter gender. Any reference to “Owner” shall mean “District.”

1.1.14 **Construction Manager.** Whenever the term “Construction Manager” or “CM” is used in the contract or elsewhere in the Contract Documents, it refers to the District assigned Construction Manager, or the District Project Manager if no CM is assigned.

1.1.15 **Days** means calendar days, unless otherwise noted as working days.

1.1.16 **Directed.** Terms such as “directed,” “requested,” “authorized,” “selected,” “approved,” “required,” and “permitted” mean directed by the Architect or the District, requested by the Architect or District, and similar phrases.

1.1.17 **District.** Whenever the term “District” is used in the Contract Documents, it refers to the Contra Costa Community College District or those persons designated by the District to act in/on its behalf.
1.1.18 **The Drawings** are graphic and pictorial portions of the Contract Documents prepared for the Project and approved changes thereto, wherever located and whenever issued, showing the design, location, and scope of the Work, generally including plans, elevations, sections, details, schedules, and diagrams as drawn or approved by the Architect.

1.1.19 **Emergency** shall be defined as a sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services. Emergency includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage.

1.1.20 **Exposed.** Whenever this term is used it shall be understood to mean any item or surface, exterior, or interior, which can be seen by a person outside the building, or seen by a person inside any usable space within the building during normal activity. Mechanical and electrical rooms, utility and service tunnels, air handling rooms, and penthouses or platforms shall be considered to have exposed surfaces, as shall the mechanical and electrical construction within them. The interior of closets and alcoves shall be considered exposed surfaces, and shall be finished to match the finish of the adjoining room or space, unless another finish is shown. The interiors of cabinets shall be considered exposed, but a finish different from that of the exterior may be permitted or specified. Spaces which are not normally occupied or used by occupants or building staff, such as shafts, hoistways, ceiling plenums, attics and crawl spaces shall be considered “concealed” spaces, unless finishes are shown or specified for their surfaces.

1.1.21 **Final Completion.** The date when all Work for the total project has been completed in accordance with the terms of the Contract Documents and has been inspected following completion of Work identified in the Punchlist Inspection and accepted by the Architect and the District. Final Completion is also sometimes referred to as Final Acceptance.

1.1.22 **Furnish.** Whenever this term is used it shall be understood to mean “purchase and deliver to the project site” ready for unloading, unpacking, assembly, installation, and similar operations.

1.1.23 **Governing Dictionary.** The definitions of words used in these Specifications, which are not defined, The General Conditions, or in referenced standards, are as given in “The American Heritage Dictionary of the English Language”.

1.1.24 **Indicated.** The term “indicated” refers to graphic representations, notes, or schedules on Drawings or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as “shown,” “noted,” “scheduled,” and “specified” are used to help the user locate the reference.

1.1.25 **Inspector of Record** is the individual retained by the District in accordance with titles 21 and 24 of the California Code of Regulations and who will be assigned to the Project. May also be referred to as the Project Inspector.
1.1.26 **Install.** Whenever this term is used it shall be understood to mean “receive, unload, inventory, store and be responsible for at the project site, transport from point of receipt to final destination, protect, unpack, erect, install in place, anchor, connect, apply, and place in operation or finish, cleaning, complete for intended use.”

1.1.27 **Installer.** An installer is the Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations. Using a term such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as “carpenter.” It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.

1.1.28 **Locality in which the work is performed** means the county in which the Project is located.

1.1.29 **Option.** Whenever this term is used it shall be understood to mean a choice from among the specified products or procedures which shall be made by the Contractor. The choice is not “whether” the work is to be performed, but “which” product or “which” procedure is to be used. The product or procedure chosen by the Contractor shall be provided at no increase in the cost to the District with no lessening of the Contractor’s responsibility for its performance. All or any options selected or proposed are still subject to all requirements for submittals and for approval of same.

1.1.30 **Or Equal and Or Approved Equal.** The terms “or equal” and “or approved equal” shall mean “or equal as approved in writing by the Architect”.

1.1.31 **The Project** is the complete construction of the Work performed in accordance with the Contract Documents.

1.1.32 **The Project Manual.** The Project Manual is the volume assembled for the Work which may include, without limitation, the bidding requirements, sample forms, Conditions of the Contract, and Specifications.

1.1.33 **The Project Site.** Project Site is the space available for performing construction activities. The extent of Project Site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built. The Project Site is also referred to as the Site.

1.1.34 **Provide** shall include “provide complete in place,” that is “furnish and install.” Complete and ready for the intended use.

1.1.35 **Punch List Inspection.** The inspection performed by the Construction Manager, Architect and the District upon written notification by the Contractor that the Work is substantially complete.
1.1.36 **Regulations.** The term “regulations” includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

1.1.37 **Remaining Work.** Remaining Work means the work required by the Contract, but not required for Substantial Completion, that the District or Architect determines has not been satisfactorily completed at the time of Substantial Completion, deferred commissioning requirements, deferred and seasonal testing, and all maintenance and operating instructions, schedules, reports, guaranties, warranties, bonds, certificates of inspection, marked-up record documents, prevailing wage compliance reports and all other documents as required by the Contract Documents. Remaining Work may also be referred to as Punch List work.

1.1.38 **Safety Orders** are those issued by any cognizant city, county, state or federal agency.

1.1.39 **Site** refers to the grounds of the Project as defined in the Contract Documents and such adjacent lands as may be directly affected by the performance of the Work. Site is also referred to as the Project Site.

1.1.40 **The Specifications.** The Specifications are that portion of the Contract Documents consisting of the written requirements for material, equipment, construction systems, instructions, quality assurance standards, workmanship, and performance of related services.

1.1.41 **Specification Language.** These Specifications are written in the imperative mood, as defined in the Construction Specifications Institute’s Manual of Practice. Imperative language is directed to the Contractor. The indicative mood is employed on occasion when such sentence structure is necessary to convey the intended meaning in a more accurate or understandable form. The text is streamlined, with the colon (:) employed as a symbol for the words “shall be”, “shall have”, “shall conform with”, “shall comply with”, or “shall meet the requirements of”. The colon is also used to separate a paragraph title or heading from the text that follows.

1.1.42 **Standards, Rules, and Regulations** referred to are recognized printed standards and shall be considered as one and a part of these specifications within limits specified. Federal, state and local regulations are incorporated into the Contract Documents by reference.

1.1.43 **Subcontractor,** as used herein, includes those having direct or indirect contracts with Contractor and ones who furnished labor, material or services for a special design according to drawings and specifications of this Work, but does not include ones who merely furnish material not so worked.

1.1.44 **Substantial Completion.** The date on which the Work or designated portion thereof, as certified by the District and Architect, is sufficiently complete, in accordance with the Contract Documents, so the District, may occupy or utilize the Work or designated portion thereof for the use for which it is intended.
1.1.45 **Surety** is the person, firm, or corporation that executes as surety the Contractor’s Performance Bond and Payment Bond.

1.1.46 **Work of the Contractor or Subcontractor** shall include all labor, materials and equipment necessary for the Contractor to fulfill all of its obligations pursuant to the Contract Documents. It shall include the initial obligation of any Contractor or Subcontractor who performs any portion of the Work, to visit the Site of the proposed Work (a continuing obligation after the commencement of the Work), to fully acquaint and familiarize itself with the conditions as they exist and the character of the operations to be carried out under the Contract Documents, and make such investigation as it may see fit so that it shall fully understand the facilities, physical conditions, and restrictions attending the Work under the Contract Documents. Each such Contractor or Subcontractor shall also thoroughly examine and become familiar with the Drawings, Specifications, and associated bid documents before preparing and submitting any bid.

1.1.47 **Workers** includes laborers, workers, and mechanics.

### 1.2 EXECUTION, CORRELATION AND INTENT

1.2.1 **Correlation and Intent**

1.2.1.1 *Documents Complementary and Inclusive.* The Contract Documents are complementary and are intended to include all items required for the proper execution and completion of the Work. All Contract Documents form the Contractor’s contract with the District. Any item of Work mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, shall be provided by Contractor as if shown or mentioned in both.

1.2.1.2 *Coverage of the Drawings and Specifications.* The Drawings and Specifications generally describe the Work to be performed by Contractor. Generally, the Specifications describe Work which cannot be readily indicated on the Drawings and indicate types, qualities, and methods of installation of the various materials and equipment required for the Work. It is not intended to mention every item of Work in the Specifications, which can be adequately shown on the Drawings, or to show on the Drawings all items of Work described or required by the Specifications even if they are of such nature that they could have been shown. All materials or labor for Work, which is shown on either the Drawings or the Specifications (or is reasonably inferable therefrom as being necessary to complete the Work), shall be provided by the Contractor to provide a complete project. It is intended that the Work be of sound, quality construction, and the Contractor shall be responsible for the inclusion of adequate amounts to cover installation of all items indicated, described, or implied in the portion of the Work to be performed by them.

1.2.1.3 **Conflicts.** In the event there is a discrepancy between the various Contract Documents, the more stringent, higher quality, and greater quantity of Work shall apply.
1.2.1.4 *Conformance With Laws.* Each and every provision of law required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though it were included herein, even if through mistake or otherwise any such provision is not inserted, or is not correctly inserted.

1.2.1.5 Before submitting its Bid, Contractor shall check and review the Drawings and Specifications for such portion for conformance and compliance with all laws, ordinances, codes, rules and regulations of all governmental authorities and public and municipal utilities affecting the construction and operation of the physical plant of the Project, all quasi-governmental and other regulations affecting the construction and operation of the physical plant of the Project, and other special requirements, if any, designated in the Contract Documents. Such checking shall include Title 21 and Title 24 of the California Code of Regulations, California Building Code, local utility, local water connection, local grading and all other applicable agencies. In the event Contractor observes any violation of any law, ordinance, code, rule or regulation, or inconsistency with the Contract Documents prior to submitting its bid or after submitting its bid if discovered thereafter, Contractor shall, within five (5) days, notify Architect and District in writing of same and shall ensure that any such violation or inconsistency shall be corrected in the manner provided hereunder prior to the construction of that portion of the Project.

1.2.1.6 The Contractor shall bear all expenses of correcting Work done contrary to said laws, ordinances, rules, and regulations if the Contractor performed same (1) without first consulting the Architect for further instructions regarding said Work or (2) disregarded the Architect's instructions regarding said work.

1.2.1.7 *Ambiguity and Inconsistency.* Before submitting its Bid, Contractor shall carefully examine all Drawings and Specifications and other information given to Contractor as to materials and methods of construction and other Project requirements. Contractor shall notify District in writing of any perceived or alleged error, inconsistency, conflict, ambiguity, or lack of detail or explanation in the Drawings and Specifications in the manner provided herein. If the Contractor or its Subcontractors, material or equipment suppliers, or any of their officers, agents, and employees performs, permits, or causes the performance of any Work under the Contract Documents, which it knows or should have known to be in error, inconsistent, or ambiguous, or not sufficiently detailed or explained, Contractor shall bear any and all costs arising therefrom including, without limitation, the cost of correction thereof without increase or adjustment to the Contract Price or the time for performance. If Contractor performs, permits, or causes the performance of any Work under the Contract Documents prepared by or on behalf of Contractor which is in error, inconsistent or ambiguous, or not sufficiently detailed or explained, Contractor shall bear any and all resulting costs, including, without limitation, the cost of correction, without increase to or adjustment in the Contract Price or the time for performance.
1.2.2 Addenda and Deferred Approvals

1.2.2.1 Addenda are the changes in specifications, drawings, and contract documents, which have been authorized in writing by the District or Architect prior to receipt of bids, and which alter, explain, or clarify the contract documents. Addenda shall govern over all other Contract Documents. Subsequent addenda issued shall govern over prior addenda unless otherwise specified in the addenda.

1.2.2.2 Deferred Approvals. Contract Documents which require deferred approval items are meant to be for illustration purposes only. Contractor is responsible for all deferred approval requirements set forth in the Contract Documents. Contractor is responsible to comply with all laws, building codes, and regulations necessary to obtain all necessary approvals, including those required from the Division of the State Architect (“DSA”) and the State Fire Marshall. Contractor shall not be granted an extension of time for failure to obtain necessary approvals due to failure to comply with laws, building codes, and other regulations (including Title 24 of the California Code of Regulations). Contractor shall schedule all deferred approval items in its progress schedule pursuant to Specification Section 01310, Construction Scheduling. If Contractor fails to include deferred-approval items in its schedule which results in a critical path delay, then Contractor shall be subject to the assessment of liquidated damages.

1.2.2.3 Deferred Approval Requirements. Deferred approvals shall be submitted and processed pursuant to the requirements of Division 1 of the Specifications. All deferred approvals shall be prepared by Contractor or Contractor’s agent early enough so as to not delay the Project. Contractor is aware that Title 21 California Code of Regulations Section 17(g) and Title 24 California Code of Regulations Section 4-317 have specific requirements for deferred approval as to governing agencies and as to the Architect and Engineer for the Project. As a result, any delay associated with the time for approval by applicable agencies or by the Architect or Architect’s consultants shall be Contractor’s.

1.2.3 Specification Interpretation

1.2.3.1 Titles. The Specifications are separated into titled sections for convenience only and not to dictate or determine the trade or craft involved.

1.2.3.2 As Shown, Etc. Where “as shown,” “as indicated,” “as detailed,” or words of similar import are used, reference is made to the Drawings accompanying the Specifications unless otherwise stated. Where “as directed,” “as required,” “as permitted,” “as authorized,” “as accepted,” “as selected,” or words of similar import are used, the direction, requirement, permission, authorization, approval, acceptance, or selection by Architect is intended unless otherwise stated.

1.2.3.3 General Conditions. The General Conditions and Supplementary General Conditions are a part of each and every section of the Specifications.
1.2.3.4 **Abbreviations.** In the interest of brevity, the Specifications are written in an abbreviated form and may not include complete sentences. Omission of words or phrases such as “Contractor shall,” “shall be,” etc., are intentional. Nevertheless, the requirements of the Specifications are mandatory. Omitted words or phrases shall be supplied by inference in the same manner as they are when a “note” occurs on the Drawings. In the interest of brevity, the Contract Documents frequently omit modifying words such as “all” and “any” and articles such as “the” and “an,” but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.2.3.5 **Plural.** Words in the singular shall include the plural whenever applicable or the context so indicates.

1.2.3.6 **Metric.** The Specifications may indicate metric units of measurement as a supplement to U.S. customary units. When indicated thus: 1” (25 mm), the U.S. customary unit is specific, and the metric unit is nonspecific. When not shown with parentheses, the unit is specific. The metric units correspond to the “International System of Units” (SI) and generally follow ASTM E 380, “Standard for Metric Practice.”

1.2.3.7 **Standard Specifications.** Any reference to standard specifications of any society, institute, association, or governmental authority is a reference to the organization’s standard specifications, which are in effect at the date of the Contractor’s proposal unless directed otherwise. If applicable specifications are revised prior to completion of any part of the Work, the Contractor may, if acceptable to Architect, perform such Work in accordance with the revised specifications. The standard specifications, except as modified in the Specifications for the Project, shall have full force and effect as though printed in the Specifications. Architect will furnish, upon request, information as to how copies of the standard specifications referred to may be obtained.

1.2.4 **Rules of Document Interpretation**

1.2.4.1 In the event of conflict within the drawings, the following rules shall apply:

(a) General Notes, when identified as such, shall be incorporated into other portions of Drawings.

(b) Schedules, when identified as such, are complementary with other notes and other portions of Drawings including those identified as General Notes.

(c) Larger scale drawings shall take precedence over smaller scale drawings.

(d) At no time shall the Contractor base construction on scaling of drawings.

1.2.4.2 Specifications shall govern as to materials, workmanship, and installation procedures.
1.2.4.3 If Contractor observes that drawings and specifications are in conflict, Contractor shall, within five (5) days, notify the Architect in writing for the purposes of obtaining an interpretation of the Contact Documents.

1.2.4.4 In the case of conflict or inconsistencies, the order of precedence shall be as follows:

(a) General Conditions take precedence over Drawings and Specifications.
(b) Special Conditions take precedence over General Conditions.
(c) The Agreement shall take precedence over the Special Conditions.
(d) In the case of disagreement or conflict between or within standards, specifications, and drawings, the more stringent, higher quality, and greater quantity of Work shall apply.

1.3 OWNERSHIP AND USE OF ARCHITECT’S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS

The Drawings, Specifications, and other contract documents for the Project are the property of the District and/or Architect pursuant to Education Code § 17316. The Contractor may retain one contract record set. Neither the Contractor nor any Subcontractor, or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications, and other documents prepared by the Architect. All copies except the Contractor’s record set, shall be returned or properly accounted for upon completion of the Work. The Drawings, Specifications, and other documents prepared by the Architect, and copies thereof furnished to the Contractor are not to be used by the Contractor or any Subcontractor, Sub-subcontractor, or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work. The District and/or Architect hereby grants the Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers a limited license to use applicable portions of the Drawings, Specifications, and other documents prepared for the Project in the execution of their Work under the Contract Documents. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the District’s property interest or other reserved right.

ARTICLE 2
DISTRICT

2.1 INFORMATION AND SERVICES REQUIRED OF THE DISTRICT
2.1.1 Site Survey.

If applicable, the District will furnish, at its expense, a legal description of the Site and a land survey showing the boundaries of the Site. Contractor shall be responsible for all surveys regarding location of construction, grading and site work.

2.1.2 Soils.

When required by the scope of the Project, the District will furnish, at its expense, the services of geotechnical engineers or consultants when reasonably required and deemed necessary by the Architect or as required by local or state codes. Such services, with written reports and appropriate written professional recommendations, may include test boring, test pits, soil bearing values, percolation tests, air and water pollution tests, and ground corrosion and resistivity tests, including necessary operations for determining subsoil, air, and water conditions.

2.1.3 Contractor Reliance.

A soils investigation report has been obtained from test holes at the Site, and such report is available for the Contractor’s use in preparing its bid and Work under this Contract. The soils report is provided for review. Any information obtained from such report or any other information given on drawings as to subsurface soil condition or to elevations of existing grades or elevations of underlying rock is approximate only. If, during the course of Work under this Contract, Contractor encounters subsurface conditions which differ materially from those indicated in the soils investigation report, then Contractor shall notify the District within five (5) calendar days of discovery of the condition, and changes to the contract price may be made in accordance with Specification Section 01250 entitled “Contract Modification Procedures.” Contractor agrees that no claim against District will be made by Contractor for damages and hereby waives any rights to damages in the event the Contractor fails to notify District within the five-day period mentioned above.

WARNING: DISTRICT DOES NOT WARRANT THE SOILS AT THE PROJECT SITE. SOILS INVESTIGATION REPORT IS PROVIDED FOR CONTRACTORS INFORMATION ONLY. CONTRACTOR HAS CONDUCTED AN INDEPENDENT INVESTIGATION OF THE PROJECT SITE AND THE SOILS CONDITIONS OF THE SITE. DISTRICT DOES NOT WARRANT THE SOILS CONDITIONS OF THE SITE AND CONTRACTOR IS FULLY RESPONSIBLE TO ASCERTAIN SITE CONDITIONS FOR THE PURPOSES OF DETERMINING CONSTRUCTION MEANS AND METHODS PRIOR TO COMMENCING CONSTRUCTION. THE SOILS INVESTIGATION REPORT IS NOT A CONTRACT DOCUMENT.

2.1.4 Utilities.

2.1.4.1 Regional Notification Center. Contractor, except in an emergency, shall contact the appropriate regional notification center at least two working days prior to commencing any
excavation if the excavation will be conducted in an area or in a private easement which is known, or reasonably should be known, to contain subsurface installations other than the underground facilities owned or operated by the District, and obtain an inquiry identification number from that notification center. No excavation shall be commenced and carried out by the Contractor unless such an inquiry identification number has been assigned to the Contractor or any subcontractor of the Contractor and the District has been given the identification number by the Contractor. Any damages arising from failure to make appropriate regional notification shall be at the sole risk of Contractor. Any delays caused by failure to make appropriate regional notification shall be at the sole risk of Contractor and shall not be considered for extension of time pursuant to Paragraph 8.4.

2.1.4.2 Utilities – Removal and Restoration

The District has endeavored to determine the existence of utilities at the Site of the Work from the records of the District of known utilities in the vicinity of the Work. The positions of these utilities as derived from such records are shown in the Contract Documents.

No excavations were made to verify the locations shown for underground utilities. The service connections to these utilities may not be shown on the drawings. It shall be the responsibility of the Contractor to determine the exact location of all service connections. The Contractor shall make its own investigations, including exploratory excavations, to determine the locations and type of service connections, prior to commencing work which could result in damage to such utilities. The Contractor shall immediately notify the District’s representative as to any utility discovered by Contractor in a different position than shown in the Contract Documents or which is not shown on the Contract Documents.

Contractor shall coordinate its Work with all utilities, including, but not limited to electricity, water, gas and telephone and meet with said utilities prior to the start of any work.

2.1.4.3 Other Utilities.

In case it should be necessary to remove, relocate, or temporarily maintain a utility because of interference with the Work, the work on the utility shall be performed and paid for as follows:

When it is necessary to remove, relocate or temporarily maintain a service connection, the cost of which is not required to be borne by the owner thereof, the Contractor shall bear all expenses incidental to the work on the service connection. The work on the service connection shall be done in a manner satisfactory to the owner thereof; it being understood that the owner of the service connection has the option of doing such work with his own forces or permitting the work to be done by the Contractor.

When it is necessary to remove, relocate, or temporarily maintain a utility which is in the position shown on the drawings, the cost of which is not required to be borne by the
owner thereof, the Contractor shall bear all expenses incidental to the work on the utility. The work on the utility shall be done in a manner satisfactory to the owner thereof; it being understood that the owner of the utility has the option of doing such work with his own forces or permitting the work to be done by the Contractor.

When it is necessary to remove, relocate, or temporarily maintain a utility which is not shown on the drawings or is in a position different from that shown on the drawings and were it in the position shown on the drawings would not need to be removed, relocated, or temporarily maintained, and the cost of which is not required to be borne by the owner thereof, the District will make arrangements with the owner of the utility for such work to be done at no cost to the Contractor, or will require the Contractor to do such work in accordance with Specification Section 01250 or will make changes in the alignment and grade of the Work to obviate the necessity to remove, relocate, or temporarily maintain the utility. Changes in alignment and grade will be ordered in accordance with Specification Section 01250.

No representations are made that the obligations to move or temporarily maintain any utility and to pay the cost thereof is or is not required to be borne by the owner of such utility, and it shall be the responsibility of the Contractor to investigate to find out whether said cost is required to be borne by the owner of the utility.

The right is reserved to governmental agencies and to owners of utilities to enter at any time upon any street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work and for the purpose of maintaining and making repairs to their property.

2.1.5 Existing Utility Lines; Removal, Relocation.

2.1.5.1 Main or Trunkline Facilities

If the Contractor while performing the contract discovers utility facilities not identified by the District in the Contract Documents, Contractor shall, within five (5) days, notify the District and utility in writing.

The District has the responsibility to identify, with reasonable accuracy, main or trunkline facilities on the drawings and specifications. In the event that main or trunkline utility facilities are not identified with reasonable accuracy in the drawings and specifications, District shall assume the responsibility for their timely removal, relocation, or protection.

The owner of the public utility shall have the sole discretion to perform repairs or relocation work or permit the Contractor to do such repairs or relocation work at a reasonable price.

The Contractor shall exercise reasonable care and shall be compensated by the District for the actual verified field costs of locating, and removing, relocating, protecting or temporarily maintaining such main or trunkline utility facilities not indicated with reasonable accuracy in the drawings and specifications, and for equipment in use on the project.
necessarily idled during such work. This work shall be performed in accordance with Specification Section 01250 of these Contract Documents.

Alternatively, District may make changes in the alignment and grade of the work to obviate the need to remove, relocate, or temporarily maintain the utility, in accordance with Specification Section 01250 or District may make arrangements with the owner of the utility for such work to be done at no cost to the Contractor.

The Contractor shall not be assessed a forfeiture for delay in completion of the Project when such delay is caused by the failure of the District or the owner of the utility to provide for the removal, relocation, protection or temporary maintenance of all such main or trunkline facilities not indicated with reasonable accuracy.

Nothing herein shall preclude the District from pursuing any appropriate remedy against the utility for delays which are the responsibility of the utility.

Nothing herein shall be construed to relieve the utility from any obligation as required either by law or by contract to pay the cost of removal or relocation of existing utility facilities.

2.1.5.2 Assessment. These subparagraphs shall not be construed to preclude assessment against the Contractor for any other delays in completion of the Work. Nothing in these subparagraphs shall be deemed to require the District to indicate the presence of existing service laterals or appurtenances whenever the presence of such utilities on the Site can be inferred from the presence of other visible facilities, such as buildings, or meter junction boxes on or adjacent to the Site.

2.1.5.3 Notification. If the Contractor, while performing Work under this Contract, discovers utility facilities not identified by the District in the Contract Documents, Contractor shall, within five (5) days, notify the District and the utility in writing. If Contractor fails to notify the District within five (5) days after discovery of any utility facilities not identified by District in the Contract Documents, Contractor waives all rights to be compensated for any extra Work or damages resulting from such discovered utilities.

2.1.6 Easements.

District shall secure and pay for easements for permanent structures or permanent changes in existing facilities, if any, unless otherwise specified in the Contract Documents.

2.2 DISTRICT’S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, including, but not limited to:
1. Failure to supply adequate workers on the entire Project or any part thereof;
2. Failure to supply a sufficient quantity of materials;
3. Failure to perform any provision of this Contract;
4. Failure to comply with safety requirements, or due to Contractor is creation of an unsafe condition;
5. In the case of bona fide emergency;
6. Failure to order materials in a timely manner;
7. Failure to prepare deferred-approval items or shop drawings in a timely manner;
8. Failure to comply with Contractor’s schedule which would result in a delay to the critical path;

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails (within a five-day period after receipt of written notice or a shorter time period expressly stated in the written notice from the District in an emergency situation) to commence and continue correction of such default with diligence and promptness, the District may correct such deficiencies without prejudice to other remedies the District may have, including those set forth in Article 14 after providing five-day written notice to Contractor and Surety. If during this five (5) day period, Surety personally delivers notice to District that it intends to perform such work, District shall allow Surety seven (7) days to perform. In an emergency situation, the District may correct such deficiencies seven (7) days to perform. In an emergency situation, the District may correct such deficiencies without prejudice to other remedies the District may have, including those set forth in Article 14 after providing 48 hours’ notice to the Contractor. In either case, the Contractor will be invoiced the cost of correcting such deficiencies, including compensation for additional services and expenses made necessary by such default, or neglect. The invoice amount shall be deducted from the next payment due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the District.

ARTICLE 3
THE CONTRACTOR

3.1 SUPERVISION AND CONSTRUCTION PROCEDURES
3.1.1 Contractor.

The Contractor shall continually supervise and direct the Work using the Contractor’s best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, procedures; and shall coordinate all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. The Contractor shall not perform the Work without utilizing the Contract Documents or, where required, approved shop drawings, product data, or samples for any such portion of the work. If any of the Work is performed by contractors retained directly by the District, Contractor shall be responsible for the coordination and sequencing of the work of those other contractors so as to avoid any impact on the project schedule pursuant to the requirements of Article 6 and Article 8. Specific duties of the Contractor shall include those set out in Section 43 of Title 21 of the California Code of Regulations and Section 4-343 of Title 24 of the California Code of Regulations. These duties include, but are not limited to the following:

(a) Responsibilities. It is the duty of the Contractor to complete the Work covered by his or her contract in accordance with the approved drawings and specifications. The Contractor in no way is relieved of any responsibility by the activities of the Architect, Engineer, Inspector or DSA in the performance of their duties.

(b) Performance of the work. The Contractor shall carefully study the approved drawings and specifications and shall plan its schedule of operations well ahead of time. If at any time it is discovered that work is being done which is not in accordance with the approved drawings and specifications, the contractor shall correct the work immediately.

All inconsistencies or times which appear to be in error in the drawings and specifications shall promptly be called to the attention of the Architect or, Engineer, for interpretation or correction. Local conditions which may affect the structure shall be brought to the Architect’s attention at once. In no case, shall the instruction of the Architect be construed to cause work to be done which is not in conformity with the approved drawings, specifications, change orders, construction change directives, and as required by law.

The Contractor shall not carry on Work except with the knowledge of the Inspector of Record.

(c) Verified Reports. The Contractor shall make and submit to the District from time to time, verified reports as required in Section 36 of Title 21 and Section 4-366 of Title 24.

Contractor shall fully comply with any and all reporting requirements of Education Code Sections 81147.

3.1.2 Contractor Responsibility.
The Contractor shall be responsible to the District for acts and omissions of the Contractor’s employees, Subcontractors, material and equipment suppliers, and their agents, employees, invitees, and other persons performing portions of the Work under direct or indirect contract with the Contractor or any of its Subcontractors.

3.1.3 Obligations not Changed by Architect’s Actions.

The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect’s administration of the Contract or by tests, inspections, or approvals required or performed by persons other than the Contractor.

3.1.4 Acceptance/Approval of Work.

The Contractor shall be responsible to determine when any completed portions of the Work already performed under this Contract or provided pursuant to Article 6 are suitable to receive subsequent Work thereon.

3.1.5 Performance of Work With Own Force.

Contractor shall perform at least 10% of the Work, exclusive of supervisory and clerical work without the services of any subcontractor. Contractor shall supervise and direct the work competently and efficiently, devoting such attention thereto and applying such skills as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall submit scope of specific work to be self-performed at same time as submission of subcontractor percent of work list required by Section 00300.

3.2 SUPERVISION

3.2.1 Full Time Supervision.

Unless personally present on the Project site where the Work is being performed, the Contractor shall keep on the Work at all times during its progress a competent construction Superintendent satisfactory to the District. The Superintendent shall be present on a full-time basis, shall be dedicated exclusively to the Project and shall not share superintendency duties with another project or job. The Superintendent shall not be replaced except with written consent of the District. The Superintendent shall represent the Contractor in its absence and shall be fully authorized to receive and fulfill any instruction from the Architect, the Inspector, the District or any other District representative. All Requests for Information shall be originated by the Superintendent and responses thereto shall be given to the Superintendent. No Work shall begin on any day by any Subcontractor or other person on the Project site until the Superintendent has arrived, or shall any Work continue during the day after the Superintendent has departed from the Project site. The Superintendent shall have authority to bind Contractor through the Superintendent’s acts. The Superintendent shall represent the Contractor, and communications given to the Superintendent shall be binding on the Contractor. Before commencing the Work, Contractor shall give written notice to District and Architect of
the name and a Statement of Qualifications of such superintendent for District approval. Superintendent shall not be changed except with written consent of District, unless a superintendent proves to be unsatisfactory to Contractor and ceases to be in its employ, in which case, Contractor shall notify District and Architect in writing. Contractor shall provide a replacement superintendent approved by the District prior to performing additional work.

3.2.2 Staff.

Notwithstanding other requirements of the contract documents, the Contractor and each Subcontractor shall: (1) furnish a competent and adequate staff as necessary for the proper administration, coordination, supervision, and superintendence of its portion of the Work; (2) organize the procurement of all materials and equipment so that the materials and equipment will be available at the time they are needed for the Work; and (3) keep an adequate force of skilled and fit workers on the job to complete the Work in accordance with all requirements of the Contract Documents.

3.2.3 Right to Remove.

District shall have the right, but not the obligation, to require the removal from the Project of any superintendent, staff member, agent, or employee of any Contractor, Subcontractor, material or equipment supplier.

3.3 LABOR AND MATERIALS

3.3.1 Contractor to Provide.

Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, material, equipment, tools, construction equipment and machinery, water, heat, air conditioning, utilities, transportation, and other facilities, services and permits necessary for proper execution and completion of the Work whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

3.3.2 Quality.

Unless otherwise specified, all materials and equipment to be permanently installed in the Project shall be new and shall be of the highest quality or as specifically stated in the Contract Documents. The Contractor shall, if requested, furnish satisfactory evidence as to kind and quality of all materials and equipment within ten (10) days of a written request by the District, including furnishing the District with bona fide copies of invoices for materials or services provided on the Project. All labor shall be performed by workers skilled in their respective trades, and shall be of the same or higher quality as with the standards of other school construction.

3.3.3 Replacement.
Any work, materials, or equipment, which do not conform to these requirements or the standards set forth in the Contract Documents, may be disapproved by the District, in which case, they shall be removed and replaced by the Contractor at no additional cost or extension of time to the District.

3.3.4 Discipline.

The Contractor shall enforce strict discipline and good order among the Contractor’s and Subcontractor’s employees, and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. As used in this subsection, “unfit” includes any person who the District concludes is improperly skilled for the task assigned to that person, who fails to comply with the requirements of this article, or who creates safety hazards which jeopardize other persons and/or property.

3.3.5 Not used.

3.3.6 Noise, Drugs, Tobacco, and Alcohol.

Contractor shall take all steps necessary to insure that employees of Contractor or any of its subcontractors’ employees do not use, consume, or work under the influence of any alcohol, tobacco or illegal drugs while on the project. Contractor shall further prevent any of its employees or its subcontractor employees from playing any recorded music devices or radios or wearing any radio headphone devices for entertainment while working on the project. Likewise, Contractor shall prevent its employees or subcontractor’s employees from bringing any animal onto the project. Contractors shall not violate any written school policies.

3.3.7 Delivery of Material.

Contractor shall place orders for materials or equipment so that the Work may be completed in accordance with the Construction schedule for the Work as set forth in Article 8 of this Agreement. Contractor shall, upon demand from the Architect, furnish to the Architect documentary evidence including, but not limited to purchase orders, invoices, bills of materials, work orders and bills of lading, showing that orders have been placed.

3.3.8 Liens and Other Security Interests of Subcontractors and Material Suppliers.

No material, supplies, or equipment for the Work shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or in any part thereof is retained by seller or supplier. Contractor warrants good title to all material, supplies, and equipment installed or incorporated in Work and agrees upon completion of all Work to deliver premises, together with all improvements and appurtenances constructed or placed thereon by it, to District free from any claims, security interests, liens, or charges. Contractor further agrees that neither it nor any person, firm, or corporation furnishing any materials or labor for any Work covered by this Contract shall have any right to place a lien upon the premises or any improvement or appurtenance thereof, except that Contractor may install metering devices or other equipment of a utility company or political subdivision, title to which is commonly retained by the utility company or political subdivision.
In event of installation of any such metering device or equipment, Contractor shall advise District as to its owner within five (5) days of such installation in writing, prior to making the installation.

3.3.9 Title to Materials.

The title to new materials or equipment for the Work of this Contract, and attendant liability for its protection and safety, shall remain with Contractor until incorporated in the Work of this Contract and accepted by the District and Architect; no part of said materials shall be removed from its place of storage, and Contractor shall keep an accurate inventory of all said materials and equipment in a manner satisfactory to the District or its authorized representative.

3.3.10 Assemblies.

For all material and equipment specified or indicated in the Drawings, the Contractor shall provide all labor, materials, equipment, and services necessary for complete assemblies and complete working systems. Incidental items not indicated on the Drawings, nor mentioned in the Specifications, that can legitimately and reasonably be inferred to belong to the Work described, or be necessary in good practice to provide a complete assembly or system, shall be furnished as though itemized in the Contract Documents in every detail. In all instances, material and equipment shall be installed in strict accordance with each manufacturer’s most recent published recommendations and specifications.

3.4 NOISE CONTROL

The Contractor shall be responsible for the installation and maintenance of noise reducing devices on construction equipment. Contractor shall comply with the requirements of the city and county having jurisdiction with regard to noise ordinances governing construction sites and activities. Construction equipment noise is subject to the control of the Environmental Protection Agency’s Noise Control Program (Part 204 of Title 40, Code of Federal Regulations).

3.5 WARRANTY

The Contractor warrants to the District and Architect that material and equipment furnished under the Contract will be of the highest quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor’s warranty and guaranty to District includes, but is not limited to the following representations:

(a) In addition to any other warranties and guaranties provided elsewhere, Contractor shall, and hereby does, warrant all Work after the date of Notice of Completion of Work by District and shall repair or replace any or all such work, together with any other work, which may be displaced in so doing that may
prove defective in workmanship or materials within a one (1) year period from date of completion as defined in Public Contract Code Section 7107(c) without expense whatsoever to District, ordinary wear and tear, unusual abuse or neglect excepted. District will give notice of observed defects with reasonable promptness. Contractor shall notify District upon completion of repairs.

(b) In the event of failure of Contractor to comply with above mentioned conditions within one week after being notified in writing, District is hereby authorized to proceed to have defects repaired and made good at expense of Contractor who hereby agrees to pay costs and charges therefore immediately on demand.

(c) If, in the opinion of the District, defective Work creates a dangerous condition or requires immediate correction or attention to prevent further loss to the District, the District will attempt to give the notice required by this Article. If the Contractor cannot be contacted or does not comply with the District’s requirements for correction within a reasonable time as determined by the District, the District may, notwithstanding the provisions of this article, proceed to make such correction or attention which shall be charged against Contractor. Such action by the District will not relieve the Contractor of the guarantee provided in this Article or elsewhere in this Contract.

(d) This Article does not in any way limit the guarantee on any items for which a longer warranty or guaranty is specified or on any items for which a manufacturer gives a guarantee for a longer period. Contractor shall furnish District all appropriate guaranty or warranty certificates upon completion of the project.

3.6 **TAXES**

Contractor will pay all applicable Federal, State, and local taxes on all materials, labor, or services furnished by it, and all taxes arising out of its operations under the Contract Documents. District is exempt from Federal Excise Tax, and a Certificate of Exemption shall be provided upon request.

3.7 **PERMITS, FEES AND NOTICES**

3.7.1 Payment.

The Contractor shall secure and pay for all permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the Work which are necessary after execution of the Contract and are legally required by any authority having jurisdiction over the Project, except those required by the Division of the State Architect (DSA). District shall be responsible for all testing and inspection as required by the DSA on-site or within the
3.7.2 Compliance.

The Contractor shall comply with and give notices required by any law, ordinance, rule, regulation, and lawful order of public authorities bearing on performance of the Work.

3.7.3 Responsibility.

The Contractor shall perform all Work in conformance with every applicable law, statute, ordinance, building code, rule or regulation. The Contractor shall assume full responsibility for such Work and shall bear the attributable cost of correction or project delay.

3.8 DSA VERIFIED REPORTS AND CERTIFICATE OF COMPLIANCE

3.8.1 Contractor Actions.

The Contractor acknowledges and agrees that a material obligation of the Contractor under the Contract Documents is the completion by the Contractor of all actions and activities which by the Contract Documents or by operation of applicable law, code, rule or regulation are the responsibility of the Contractor relating to DSA reporting requirements pursuant to Education Code §81141 (including amendments thereto) and issuance of DSA’s Certificate of Compliance for the Project pursuant to Education Code §81147 (including amendments thereto) upon completion of Project construction. The foregoing shall include without limitation, the timely preparation, completion and filing of Verified Reports during Project construction and the filing of the Final Verified Report with DSA within ten (10) days of the determination of Project Final Completion. The Contractor shall provide the Project Inspector, Architect, Construction Manager retained by the District for the Project and the District with copies of all Verified Reports completed by the Contractor and submitted to DSA; such copies shall be provided to the Project Inspector, Architect, the Construction Manager and the District concurrently with the Contractor’s submission thereof to DSA.

3.8.2 Final Verified Report.

Notwithstanding any provision of the Contract Documents to the contrary, the completion and filing of the Final Verified Report with DSA by the Contractor is an express condition precedent to the District’s disbursement of Twelve Thousand Dollars ($12,000) of the Contract Price due the Contractor under this Agreement (“the Final Verified Report”). The Final Verified Report is in addition to, and not in lieu of, retention withheld and retained by the District from Progress Payments disbursed to the Contractor during construction. The District’s disbursement of the Final Verified Report to the Contractor shall be made by the District within thirty (30) days of the presentation by the Contractor to the District, Project Inspector, and Architect, of reasonably satisfactory written evidence that the Contractor has filed the Contractor’s Final Verified Report with DSA in accordance with the preceding and the
submission of a billing statement by the Contractor to the District for payment of the Final Verified Report. If the Contractor fails to file the Final Verified Report with DSA within ten (10) days of the determination of the Contract Final Completion, notwithstanding the preparation or filing of such Final Verified Report by the Contractor thereafter, the District may in the sole and exclusive discretion of the District withhold from disbursement to the Contractor all or any part of the Final Verified Report as damages for the failure of the Contractor to have timely discharged its obligations hereunder.

3.9 **(Not used)**

3.10 **DOCUMENTS AND SAMPLES AT THE SITE**

The Contractor shall maintain at the Site for the District one current copy of the International Building Code, Titles 19, 21 and 24 of the California Code of Regulations and one record copy of the Drawings, Specifications, Addenda, Change Orders, and other Modifications, in good order and marked currently to record changes and selections made during construction. In addition, the Contractor shall maintain at the Site approved Shop Drawings, Product Data, Samples, and similar required submittals. These documents shall be available to the Architect and shall be delivered to the Architect for delivery to the District upon completion of the Work.

3.11 **SUBSTITUTIONS**

3.11.1 **NOT USED**

3.11.2 **NOT USED**

3.11.3 **NOT USED**

3.11.4 **PRODUCT SUBSTITUTIONS**

3.11.4.1 *One Product Specified.* Unless the Specifications state that no substitution is permitted, whenever the Contract Documents indicate any specific article, device, equipment, product, material, fixture, patented process, form, method, or type of construction or any specific name, make, trade name, or catalog number, with or without the words “or equal,” such specification shall be deemed to be used for the purpose of facilitating description of the material, process, or article desired and shall be deemed to be followed by the words “or equal” unless the Contract Documents specify “no substitution allowed”, “no equal”, “no equivalent”, “to match campus standard”, or other language with similar meaning, in which case no substitutions will be allowed. Pursuant to Paragraph 3.11.4.3, the Contractor may, unless otherwise stated, at time of bid offer any material, process, article, etc., which shall be materially equal or better in every respect to that so indicated or specified (“Specified Item”) and will completely accomplish the purpose of the Contract Documents.
3.11.4.2 *Products Specified Which are Commercially Unavailable.* If the Contractor fails to make a request for substitutions for products, with its bid, and such products subsequently become commercially unavailable, the Contractor may request a substitution for such commercially unavailable item. The decision to grant this request is solely at the District’s discretion. The written approval of the District, consistent with the procedure for Change Orders, shall be required for the use of a proposed substitute material. The District may condition its approval of the substitution upon the delivery to District of an extended warranty or guaranty or other assurances of adequate performance of the substitution as well as an equitable deduction in the contract price should the substituted item cost less than the Specified Item. All risks of delay due the approval of a requested substitution by the DSA, or any other governmental agency having jurisdiction, shall be on the requesting party. All additional costs, all procurement and construction delays, and all costs for review by the Architect or its consultants shall be the responsibility of the Contractor and will be deducted from Contractor’s pay request.

3.11.4.3 *Substitution Request Form.* Requests for substitutions of products, materials, or processes in place of a Specified Item must be submitted in writing on the District’s Substitution Request Form (“Request Form”) within three (3) work days after bid opening, except as provided for in Paragraph 3.11.4.2.

The Request Form must be accompanied by evidence as to whether the proposed substitution:

1. Is equal in quality/service/ability to the Specified Item;
2. Will entail no changes in detail, construction, and scheduling of related work;
3. Will be acceptable in consideration of the required design and artistic effect;
4. Will provide no cost disadvantage to the District;
5. Will require no excessive or more expensive maintenance, including adequacy and availability of replacement parts; and
6. Will required no change of the construction schedule.

3.11.4.4 In completing the Request Form, the bidder must state, with respect to each requested substitution, whether the bidder will agree to provide the Specified Item in the event that the District denies the bidder’s request for such requested substitution. In the event that the bidder has agreed in the Request Form to provide the Specified Item and the District denies the bidder’s requested substitution for a Specified Item, the bidder shall provide the Specified Item without any additional cost or charge to the District.

3.11.4.5 After bids are opened, the apparent lowest bidder shall provide, within ten (10) days of opening such bids, any and all Drawing, Specifications, samples, performance data, calculations, and other information, as may be required to assist the Architect and the District in determining whether the proposed substitution is acceptable. The burden of establishing these facts shall be upon the bidder.
3.11.4.6 After the District’s receipt of such evidence by the bidder, the District will make its final decision as to whether the bidder’s request for substitution for any Specified Items will be granted. The decision as to whether a proposed request for substitution is equal to a Specified Item shall be at the sole discretion of the District. Any request for substitution that is granted by the District shall be documented and processed through a Change Order. The District may condition its approval of any substitution upon delivery to the District of an extended warranty or guaranty or other assurances of adequate performance of the substitution. Any and all risks of delay due to approval by the DSA or any other governmental agency having jurisdiction shall be on the bidder.

3.11.4.7 If the Architect and District accept a proposed substitution, the Contractor agrees to pay for all engineering and design services, including, without limitation, compensation to the Architect and affected engineers for their required time to process such substitution through the Division of the State Architect, if required, and to make all changes and adjustments in materials or the work of all trades directly or indirectly affected by the substituted item or items at no cost to the District.

3.12 **INTEGRATION OF WORK**

3.12.1 Scope.

The Contractor shall be responsible for cutting, fitting, or patching to complete the Work and to make all parts fit together properly. Contractor shall be responsible for ensuring that all trades are coordinated and scheduled so as to ensure the timely and proper execution of the work. When modifying existing work or installing new Work adjacent to existing work, Contractor shall match, as closely as conditions of Site and materials will allow, the finishes, textures, and colors of the original work, refinishing existing work at no additional cost to District. All cost caused by defective or ill-timed work shall be borne by Contractor. Contractor shall be solely responsible for protecting existing work on adjacent properties and shall obtain all required permits for shoring and excavations near property lines.

3.12.2 Structural Members.

New or existing structural members and elements, including reinforcing bars and seismic bracing, shall not be cut, bored, or drilled except by written authority of the Architect. Work done contrary to such authority is at the Contractor’s risk and subject to replacement at its own expense without reimbursement under the Contract. Schedule delays resulting from Agency approvals for unauthorized work shall be the Contractor’s responsibility.

3.12.3 Subsequent Removal.

Permission to patch any areas or items of the Work shall not constitute a waiver of the District’s or the Architect’s right to require complete removal and replacement of the areas of items of the Work if, in the opinion of the Architect or the District, the patching does not satisfactorily restore quality and appearance of the Work or does not otherwise conform to the Contract Documents.
3.13 **CLEANING UP**

3.13.1 Contractor’s Responsibility.

Contractor at all times shall keep premises free from debris such as waste, dust, excess water, storm water runoffs, rubbish, and excess materials and equipment. Contractor shall not leave debris under, in, or about the premises, but shall promptly remove same from the premises and dispose of it in a lawful manner. Disposal receipts or dump tickets shall be furnished to the Architect within five (5) days of request. Upon completion of Work, Contractor shall clean interior and exterior of buildings, including fixtures, equipment, walls, floors, ceilings, roofs, window sills and ledges, horizontal projections, and any areas where debris has collected, so surfaces are free from foreign material or discoloration; Contractor shall clean and polish all glass, plumbing fixtures, equipment, finish hardware and similar finish surfaces. Upon completion of the Work, Contractor shall also remove temporary utilities, fencing, barricades, planking, sanitary facilities and similar temporary facilities from Site.

Contractor shall remove rubbish and debris resulting from the Work on a daily basis. Contractor shall maintain the structures and Site in a clean and orderly condition at all times until acceptance of the project by the District. Contractor shall keep its access driveways and adjacent streets, sidewalks, gutters and drains free of rubbish, debris and excess water by cleaning and removal each day.

3.13.1.1 In addition to the general cleaning, the following special cleaning shall be done at the completion of the work in accordance with the specifications including, but not limited to:

(a) Remove putty stains from glazing, then wash and polish glazing.

(b) Remove marks, stains, fingerprints and other soil or dirt from painted, stained or decorated work.

(c) Remove temporary protection and clean and polish floors and waxed surfaces.

(d) Clean and polish hardware and plumbing trim; remove stains, dust, dirt, plaster and paint.

(e) Remove spots, soil, plaster and paint from tile work, and wash tile.

(f) Clean all fixtures and equipment, remove excess lubrication, clean light fixtures and lamps, polish metal surfaces.

(g) Vacuum-clean carpeted surfaces.

(h) Remove debris from roofs, down spout and drainage system.

3.13.2 Failure to Cleanup.
If the Contractor fails to clean up as provided in the Contract Documents, the District may do so, and the cost thereof shall be the responsibility of the Contractor and deducted from the next progress payment.

### 3.14 ACCESS TO WORK

The Contractor shall provide the District, the Architect, Engineers and the Inspector of Record, access to the Work in preparation and progress wherever located. Contractor shall provide safe and proper facilities for such access so that District’s representatives may perform their functions.

### 3.15 ROYALTIES AND PATENTS

#### 3.15.1 Payment and indemnity for Infringement.

Contractor shall hold and save the District and its officers, agents, and employees, the Architect, and the Architect’s consultants harmless from liability of any nature or kind, including cost and expense, for or on account of any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the contract, including its use by the District, unless otherwise specifically provided in the contract documents, and unless such liability arises from the sole negligence, or active negligence, or willful misconduct of the District, the Architect, or the Architect’s consultants.

#### 3.15.2 Review.

The review by the Architect of any method of construction, invention, appliance, process, article, device, or material of any kind shall be for its adequacy for the Work and shall not be an approval for the use by the Contractor in violation of any patent or other rights of any person or entity.

### 3.16 INDEMNIFICATION

#### 3.16.1 Contractor.

Contractor shall defend, indemnify and hold harmless District, Architect, Inspector, the State of California and their officers, employees, agents and independent contractors from all liabilities, claims, actions, liens, judgments, demands, damages, losses, costs or expenses of any kind arising from death, personal injury, property damage or other cause based or asserted upon any act, omission, or breach connected with or arising from the progress of Work or performance of service under this Agreement or the Contract Documents. As part of this indemnity, Contractor shall protect and defend, at its own expense, District, Architect, Inspector, the State of California and their officers, employees, agents and independent contractors from any legal action including attorneys fees or other proceeding based upon such act, omission, or breach.
Furthermore, Contractor agrees to and does hereby defend, indemnify and hold harmless District, Architect, Inspector, the State of California and their officers, employees, agents and independent contractors from every claim or demand made, and every liability, loss, damage, expense or attorneys fees of any nature whatsoever, which may be incurred by reason of:

(a) Liability for (1) death or bodily injury to persons; (2) damage or injury to, loss (including theft), or loss of use of, any property; (3) any failure or alleged failure to comply with any provision of law or the Contract Documents; or (4) any other loss, damage or expense, sustained by any person, firm or corporation or in connection with the Work called for in this Agreement or the Contract Documents, except for liability resulting from the sole or active negligence, or the willful misconduct of the District.

(b) Any bodily injury to or death of persons or damage to property caused by any act, omission or breach of Contractor or any person, firm or corporation employed by Contractor, either directly or by independent contract, including all damages or injury to, loss (including theft), or loss of use of, any property, sustained by any person, firm or corporation, including District, arising out of or in any way connected with Work covered by this Agreement or the Contract Documents, whether said injury or damage occurs either on or off District property, but not for any loss, injury, death or damages caused by the sole or active negligence or willful misconduct of the District.

(c) Any dispute between Contractor and Contractor’s subcontractors/supplies/sureties, including, but not limited to, any failure or alleged failure of the Contractor (or any person hired or employed directly or indirectly by the Contractor) to pay any Subcontractor or Materialman of any tier or any other person employed in connection with the Work and/or filing of any stop notice or mechanic’s lien claims.

Contractor, at Contractor’s own expense, cost, and risk, shall defend any and all claims, actions, suits, or other proceedings that may be brought or instituted against the District, its officers, agents or employees, on any such claim or liability, and shall pay or satisfy any judgment that may be rendered against the District, its officers, agents or employees in any action, suit or other proceedings as a result thereof.

Contractor shall ensure that its contract with each of its subcontractors contains provisions requiring the subcontractors to defend, indemnify and hold harmless the District, Architect, Inspector, the State of California to a minimum level as set forth in this Article and consistent with the language of 3.15.1.

The Contractor’s and Subcontractors’ obligation to defend, indemnify and hold harmless the District, Architect, Inspector, the State of California and their officers, employees, agents and independent contractors hereunder shall include, without limitation, any and all claims, damages, and costs for the following: (1) any damages or injury to or death of any person,
and damage or injury to, loss (including theft), or loss of use of, any property; (2) breach of any
warranty or guaranty, express or implied; (3) failure of the Contractor or Subcontractors to
comply with any applicable governmental law, rule, regulation, or other requirement; and (4)
products installed in or used in connection with the Work.

3.17 SUBMISSION OF DAILY REPORTS

3.17.1 General.

At the close of each working day, the Contractor shall submit a daily report to the
District and the Inspector, on forms approved by the District, together with applicable delivery
tickets, listing all labor, materials, and equipment involved for that day. An attempt shall be
made to reconcile the report daily, and it shall be signed by a District representative and the
Contractor. In the event of disagreement, pertinent notes shall be entered by each party to
explain points which cannot be resolved that day. Each party shall retain a signed copy of the
report. Reports by subcontractors or others shall be submitted through the Contractor.

3.17.2 Labor.

The report required by Paragraph 3.17.1 shall show names of workers, classifications,
hours worked and hourly rate. Project superintendent expenses are not allowed.

3.17.3 Materials.

The report required by Paragraph 3.17.1 shall describe and list quantities of materials
used and unit costs.

3.17.4 Equipment.

The report required by Paragraph 3.17.1 shall show type of equipment, size,
identification number, and hours of operation, including loading and transportation, if
applicable, and hourly/daily cost. Move-on and move-off fees, if allowable, shall be noted.

3.17.5 Other Services and Expenditures.

Other services and expenditures shall be described in detail as the District requires.

ARTICLE 4
ADMINISTRATION OF THE CONTRACT

4.1 ARCHITECT

4.1.1 Replacement of Architect.
In the case of the termination of the Architect, the District may appoint an architect or another construction professional or may perform such functions with its own licensed professional personnel. The status of the replacement Architect under the Contract Documents shall be the same as that of the former architect.

4.2 ARCHITECT’S ADMINISTRATION OF THE CONTRACT

4.2.1 Status.

Pursuant to Titles 24 and 21 of the California Code of Regulations and as required pursuant to the Field Act, Education Code 17280 et. Seq. the Architect will provide administration of the Contract Documents and the Work, and will be a District representative during construction, as well as during the one (1) year period following the commencement of any warranties or guaranties. The Architect will have authority to act on behalf of the District only to the extent provided in the Contract Documents.

4.2.2 Site Visits.

The Architect will visit the Site at intervals necessary in the judgment of the Architect to become generally familiar with the progress and quality of the Work and to determine in general if the Work is being performed in accordance with the Contract Documents.

4.2.3 Limitations of Construction Responsibility.

The Architect shall not have control over, charge of, or be responsible for construction means, methods, techniques, schedules, sequences or procedures, fabrication, procurement, shipment, delivery, receipt, installation, or for safety precautions and programs in connection with the Work, since these are solely the Contractor’s responsibility under the Contract Documents. The Architect shall not be responsible for the Contractor’s, Subcontractors’, material or equipment suppliers’, or any other person’s schedules or failure to carry out the Work in accordance with the Contract Documents. The Architect shall not have control over or charge of acts or omissions of the Contractor, Subcontractors, their agents or employees, or any other persons or entities performing or supplying portions of the Work. The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect’s administration of the Contract Documents, or by tests, inspections, or approvals required or performed by persons other than the Contractor.

4.2.4 Communications Facilitating Contract Administration.

Except as otherwise provided in the Contract Documents the Contractor shall communicate through the District representative. The District representative shall be promptly informed, and shall receive copies of all written communications. Contractor shall not rely upon any communications from the District that is not from the District’s representative. Communications by and with
the Architect’s consultants shall be through the Architect. Communications by and with Subcontractors and material or equipment suppliers shall be through the Contractor.

4.2.5 Payment Applications.

The Architect will review and make recommendations to the District regarding the amounts due the Contractor on the Certificates for Payment pursuant to Specification Section 01290 and subject to the Inspector’s approval and Architect’s observation.

4.2.6 Rejection of Work.

In addition to the rights, duties, and obligations of the Inspector under this Article, the Architect may recommend to the District that the District reject Work which does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable to achieve the intent of the Contract Documents, the Architect may recommend to the District that the District require additional inspection or testing of the Work in accordance with Paragraph 13.5, whether or not such Work is fabricated, installed, or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work.

4.2.7 Warranties and Guaranties Upon Completion.

The Architect, in conjunction with the District and Inspector will conduct field reviews of the Work to determine the date of completion, shall receive and forward to the District for the District’s review and records written warranties, guaranties, and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment when the Architect believes the Work has been completed in compliance with the requirements of the Contract Documents. The handling by the Architect of such warranties, guaranties, maintenance manuals, or similar documents shall not diminish or transfer to the Architect any responsibilities or liabilities required by the Contract Documents of the Contractor or other entities, parties, or persons performing or supplying the Work.

The Architect will conduct a field review of the Contractor’s comprehensive list of items to be completed or corrected (final punch list) and one (1) follow-up field review if required. The cost incurred by the District for further field reviews or the preparation of further punch lists by the Architect shall be invoiced to the Contractor and deducted from the final payment.

4.2.8 Interpretation.

The Architect will interpret and decide matters concerning performance and requirements of the Contract Documents.

4.2.9 Additional Instructions.
4.2.9.1 *Typical Parts and Sections.* Whenever typical parts or sections of the Work are completely detailed on the Drawings, and other parts or sections which are essentially of the same construction are shown in outline only, the complete details shall apply to the Work which is shown in outline.

4.2.9.2 *Dimensions.* Dimensions of Work shall not be determined by scale or rule. Figured dimensions shall be followed at all times. If figured dimensions are lacking on Drawings, Architect shall supply them on request. The Architect’s decisions on matters relating to aesthetic effect will be final.

4.3 **INSPECTOR OF RECORD**

4.3.1 **General.**

One or more project inspectors employed by the District and approved by the Division of the State Architect will be assigned to the Work in accordance with the requirements of Title 24 of the California Code of Regulations. The Inspector(s) duties are as specifically defined in Title 24.

4.3.2 **Inspector’s Duties.**

All Work shall be under the observation of the Inspector. The Inspector shall have free access to any or all parts of the Work at any time. The Contractor shall furnish the Inspector such information as may be necessary to keep the Inspector fully informed regarding progress and manner of Work and character of materials. Such observations shall not, in any way, relieve the Contractor from responsibility for full compliance with all terms and conditions of the Contract, or be construed to lessen to any degree the Contractor’s responsibility for providing efficient and capable superintendence. The Inspector is not authorized to make changes in the drawings or specifications nor shall the Inspector’s approval of the Work and methods relieve the Contractor of responsibility for the correction of subsequently discovered defects, or from its obligation to comply with the Contract Documents.

4.3.3 **Inspector’s Authority to Reject or Stop Work.**

The Inspector shall have the authority to reject Work whenever provisions of the Contract Documents are not being complied with, and Contractor shall instruct its Subcontractors and employees accordingly. In addition, the Inspector may stop any Work that poses a probable risk of harm to persons or property. The Contractor shall instruct its employees, Subcontractors, material and equipment suppliers, etc., accordingly. The absence of any Stop Work order or rejection of any portion of the Work shall not relieve the Contractor from any of its obligations pursuant to the Contract Documents.

4.3.4 **Not used.**

4.3.5 **Testing Times.**
The District will provide inspection and testing at its cost during the normal eight (8) hour day Monday through Friday (except holidays). Work by the Contractor outside of the normal eight (8) hour day shall constitute an authorization from the Contractor to the District to provide inspection and testing as required outside of the normal eight (8) hour day. Contractor shall reimburse District for any additional costs associated with inspection and testing (including re-inspection and re-testing) outside the normal eight-hour day and for any retests caused by the Contractor.

4.4 RESPONSIBILITY FOR ADDITIONAL CHARGES INCURRED BY THE DISTRICT FOR PROFESSIONAL SERVICES

If at any time prior to the completion of the requirements under the Contract Documents, the District is required to provide or secure additional professional services for any reason by any act of the Contractor, the Contractor shall be invoiced by the District for any costs incurred for any such additional services, which costs shall be deducted from the next progress payment. Such invoicing shall be independent from any other District remedies and shall not be considered a waiver of any District rights or remedies. If payments then or thereafter due to the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the District. Additional services shall include, but shall not be limited to, the following:

(a) Services made necessary by the default of the Contractor.

(b) Services made necessary due to the defects or deficiencies in the Work of the Contractor.

(c) Services required by failure of the Contractor to perform according to any provision of the Contract Documents.

(d) Services in connection with evaluating substitutions of products, materials, equipment, Subcontractors’ proposed by the Contractor, and making subsequent revisions to drawings, specifications, and providing other documentation required (except for the situation where the specified item is no longer manufactured or available).

(e) Services for evaluating and processing claims submitted by the Contractor in connection with the Work outside the established Change Order process.

(f) Services required by the failure of the Contractor to prosecute the Work in a timely manner in compliance within the specified time of completion.

(g) Services in conjunction with the testing, adjusting, balancing and start-up of equipment other than the normal amount customarily associated for the type of Work involved.
(h) Services in conjunction with more than one (1) re-review of submittals of shop drawings, product data, samples, etc.

4.5 **DISPUTES**

4.5.1 Decision of Architect.

Disputes between District and Contractor involving money or time, including those alleging an error or omission by the Architect, shall be referred initially to the Architect for action as provided in Paragraph 4.5.2. A decision by the Architect, as provided in Paragraph 4.5.5, shall be required as a condition precedent to proceeding with remedies set forth in Paragraph 4.5.6 as to all such matters arising prior to the date final payment is due, regardless of whether such matters relate to execution and progress of the Work, or the extent to which the Work has been completed. The decision by the Architect in response to a Claim shall not be a condition precedent to the remedies under Paragraph 4.5.2 through 4.5.5 in the event: (1) the position of Architect is vacant; (2) the Architect has not received evidence or has failed to render a decision within agreed time limit; (3) the Architect has failed to take action required under Paragraph 4.6.4 within thirty (30) days after the Claim is made, forty-five (45) days have passed after the Claim has been referred to the Architect; or (4) the Claim relates to a Stop Notice Claim not arising from any extra change order or Construction Change Directive for which approval has not been provided.

4.5.2 Architect’s Review.

The Architect will review Claims and take one or more of the following preliminary actions within ten (10) days of receipt of a Claim: (1) request additional supporting data from the Claimant; (2) submit a schedule to the parties indicating when the Architect expects to take action; (3) reject the Claim in whole or in part, stating reasons for rejection; (4) recommend approval of the Claim; or (5) suggest a compromise. The Architect may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

4.5.3 Documentation if Resolved.

If a Claim has been resolved, the Architect will prepare or obtain appropriate documentation.

4.5.4 Actions if Not Resolved.

If a Claim has not been resolved and all documentation requested pursuant to Paragraph 4.5.2 has been provided, the party making the Claim shall, within ten (10) days after the Architect’s preliminary response, take one or more of the following actions: (1) modify the initial Claim; (2) notify the Architect that the initial Claim stands; or (3) supplement with additional supporting data.

4.5.5 Architect’s Written Decision.
If a Claim has not been resolved after consideration of the foregoing and of other evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect’s decision will be made within twenty (20) days. Upon expiration of such time period, the Architect will render to the parties its written decision relative to the Claim, including any change in the Contract Sum or Contract Time or both. The Architect may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy.

4.5.6 Continuing Contract Performance.

Pending final resolution of a Claim, including, negotiation, mediation, arbitration, or litigation, the Contractor shall proceed diligently with performance of the Contract, and the District shall continue to make any undisputed payments in accordance with the Contract. If the dispute is not resolved, Contractor agrees it will neither rescind the contract nor stop the progress of the work, but Contractor’s sole remedy shall be to submit such controversy to determination by a court of competent jurisdiction in the county where the project is located, after the project has been completed, and not before. At the District’s sole option, the District may submit individual disputes for binding arbitration and Contractor agrees to the resolution determined for each individual dispute by Arbitrator, including resolution of time and delays. If binding arbitration is utilized for individual disputes, such resolution is full and final as to that particular Claim.

4.5.7 Claims for Concealed Trenches or Excavations Greater Than Four Feet Below the Surface.

When any excavation or trenching extends greater than four feet below the surface or if any condition involving hazardous substances are encountered:

(a) Immediately upon discovery, The Contractor shall promptly, and before the following conditions are disturbed, notify the District, by telephone and in writing, of the condition except:

1. If such condition is a hazardous waste condition, and Contractor’s bid includes removal or disposal of hazardous substances. Material that the Contractor believes may be a material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with the provisions of existing law. In such case, the notice bulletin procedures of Specification Section 01250 apply.

2. Subsurface or latent physical conditions at the Site differing from those indicated.

3. Unknown physical conditions at the Site of any unusual nature, different materially from those ordinarily encountered and generally
recognized as inherent in Work of the character provided for in the Contract.

(b) The District shall investigate the conditions, and if District finds that the conditions do materially so differ, do involve hazardous waste, and cause a decrease or increase in the Contractor’s cost of, or the time required for, performance of any part of the Work shall issue a change order or construction change directive under the procedures described in the Contract.

(c) In the event that a dispute arises between the District and the Contractor whether the conditions materially differ, involve hazardous waste, or cause a decrease or increase in the Contractor’s cost of, or time required for, performance of any part of the work, the Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all Work to be performed under the Contract. The Contractor shall retain any and all rights provided either by Contract or by law which pertain to the resolution of disputes and protests between the contracting parties.

4.5.8 Claims for Extension of Time.

If Contractor and District cannot agree upon an extension of time, whether compensable or not, then Contractor must have first completed the procedures set forth in Paragraph 8.4. Upon completion of the procedures set forth under Paragraph 8.4, Contractor must then comply with the requirements in this Article including those set forth under Paragraph 4.5.9.

4.5.9 Claims Procedures.

4.5.9.1 Procedure applicable to all Claims:

(a) Definition of Claim: A “Claim” means a separate demand by the Contractor for (1) time extension, (2) payment of money or damages arising from Work done by or on behalf of the Contractor pursuant to the CONTRACT and payment of which is not otherwise expressly provided for or the Claimant is not otherwise entitled to, or (3) and amount the payment of which is disputed by the District.

(b) Filing Claim is Not Basis To Discontinue Work: The Contractor shall promptly comply with Work under the Contract or Work requested by the District even though a written Claim has been filed. The Contractor and the District shall make good faith efforts to resolve any and all Claims that may arise during the performance of the Work covered by this contract.

(c) Claim Notification: The Contractor shall within seven (7) calendar days after the Claim arises, submit a notification, in writing, with the District stating clearly the basis for the Claim. If the notification is not submitted within seven (7) days after the Claim arises, the Contractor shall be deemed to have waived all
right to assert the Claim, and the Claim shall be denied. Claims submitted after the final payment date shall also be considered null and void by the District. All Claims shall be reviewed pursuant to Paragraph 4.5.1, 4.5.2, and 4.5.5. In order to qualify as a Claim, the written notice must state that it is a Claim submitted under this paragraph of these General Conditions.

(d) **Formal Claim Appeal Submission:** If the Contractor does not concur with the District’s decision regarding the Claim Notification, the Contractor will issue a formal Claim Appeal within fourteen (14) days of receipt of the District’s decision and all detailed information in support of the Claim Appeal within thirty (30) days. All appeals shall be submitted before final payment. If the Claim Appeal is not submitted within fourteen (14) calendar days and detailed information within thirty (30) days, the Contractor shall be deemed to have waived its right to assert the Claim and the Claim shall be denied. Contractor’s failure to submit any detailed information which is in the possession of Contractor shall render such information inadmissible by Contractor at trial or arbitration.

(e) **Appeal Claim Format:** The Contractor shall provide all written detailed documentation which supports the Claim, including but not limited to: arguments, justifications, cost, estimates, schedule analysis and detailed documentation. The format of the Claim Appeal shall be as follows:

1. **Cover letter.**
2. **Summary of factual basis of Claim and amount of Claim.**
3. **Summary of the basis of the Claim, including the specific clause and section under the Contract under which the Claim is made.**
4. **Documents relating to the Claim, including:**
   a. Specifications
   b. Drawings
   c. Clarifications (RFI’s)
   d. Other relevant information
   e. Analysis of claim merit.
   f. Analysis of claim cost.
   g. For Claims relating to time extensions, an analysis and supporting documentation evidencing any effect upon the critical path.
   h. Certification.
   i. Chronology of events and related correspondence.
   j. Daily reports and logs.

(f) **Certification:** The Contractor (and subcontractors, if applicable) shall submit with the Claim a certification under penalty of perjury:
1. That the Contractor has reviewed the Claim and that such Claim is made in good faith;

2. Supporting data are accurate and complete to the best of the Contractor’s knowledge and belief;

3. The amount requested accurately reflects the amount of compensation for which the Contractor believes the District is liable.

4. That the Contractor is familiar with Government Code Sections 12650 et seq. and Penal Code Section 72 and that false Claims can lead to substantial fines and/or imprisonment.

(g) Signature of Certification: If the Contractor is not an individual, the certification shall be executed by an officer or general partner of the Contractor having overall responsibility for the conduct of the Contractor’s affairs.

(h) Mandatory Claim Appeal Procedure: The Contractor’s Claim Appeal shall be denied if it fails to provide the written basis of the Claim and certification as set forth herein.

(i) District May Request Additional Information: Within thirty (30) days of receipt of the Claim Appeal and the information under this Article, the District may request in writing any additional documentation supporting the Claim or documentation relating to defenses to the Claim which the District may assert.

4.5.9.2 Binding Arbitration of Individual Claim Issues. At the District’s sole option, the District may submit individual disputes, or Claims, to binding arbitration and Contractor agrees to the resolution determined for each individual dispute by Arbitrator, including resolution of time and delays. If binding arbitration is utilized, such resolution is a full and final resolution of the particular Claim or dispute. Under no circumstances may the Contractor stop work, rescind its contract or otherwise slow the progress of Work during resolution of individual Claims in binding Arbitration.

4.5.9.3 Resolution of Disputes in Court of Competent Jurisdiction. If Claims are not resolved under the procedure set forth and pursuant to Article 4.5.9.2, such Claim or controversy shall be submitted to a court in the county of competent jurisdiction after the Project has been completed, and not before.

4.5.9.4 Warranties, Guaranties and Obligations. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guaranties and obligations imposed upon
Contractor by the General Conditions and amendments thereto; and all of the rights and remedies available to District and Architect thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by laws or regulations by special warranty or guaranty or by other provisions of the Contract Documents, and the provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

ARTICLE 5
SUBCONTRACTORS

5.1 DEFINITIONS

5.1.1 Subcontractual Relations

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the same obligations and responsibilities, assumed by Contractor pursuant to the Contract Documents. Each subcontract agreement shall preserve and protect the rights of the District and the Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound. Upon written request of the Subcontractor, the Contractor shall identify to the Subcontractor the terms and conditions of the proposed subcontract agreement, which may be at variance with the Contract Documents. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

5.1.2 Subcontractor Licenses.

All subcontractors shall be properly licensed by the California State Licensing Board.

5.1.3 Substitution of Subcontractor

Substitution of Subcontractors shall be permitted only as authorized under Public Contract Code §§ 4107 et. Seq. Any substitutions of Subcontractors shall not result in any increase in the Contract Price or result in the granting of any extension of time for the completion of the Project.

5.1.4 Contingent Assignment of Subcontracts and Other Contracts
Each subcontract and other contract or agreement for any portion of the Work is hereby assigned by the Contractor to the District provided that:

(a) Such assignment is effective only after termination of this contract with the Contractor by the District as provided herein and only for those subcontracts and other contracts and agreements that the District accepts by notifying the Subcontractor or Materialman (as may be applicable) in writing; and

(b) Such assignment is subject to the prior rights of the Surety(ies) obligated under the Payment Bond and Performance Bond.

The Contractor shall include adequate provisions for this contingent assignment of subcontracts and other contracts and agreements in each such document.

ARTICLE 6
CONSTRUCTION BY DISTRICT OR BY SEPARATE CONTRACTORS

6.1 DISTRICT’S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 Separate Contracts.

(a) District reserves the right to let other contracts in connection with this Work. Contractor shall afford other contractors reasonable opportunity for (1) introduction and storage of their materials; (2) access to the Work; and (3) execution of their work. Contractor shall properly connect and coordinate its work with that of other Contractors.

(b) If any part of Contractor’s Work depends on proper execution or results of any other contractor, the Contractor shall inspect and within seven (7) days or less, report to Architect, in writing, any defects in such work that render it unsuitable for proper execution of Contractor’s work. Contractor will be held accountable for damages to District for that work which it failed to inspect or should have inspected. Contractor’s failure to inspect and report shall constitute its acceptance of other contractors’ work as fit and proper for reception of its work, except as to defects which may develop in other contractors’ work after execution of Contractor’s work.

(c) To ensure proper execution of its subsequent Work, Contractor shall measure and inspect Work already in place and shall at once report to the Architect in writing any discrepancy between executed Work as built and the Contract Documents.
(d) Contractor shall ascertain to its own satisfaction the scope of the Project and nature of any other contracts that have been or may be awarded by District in prosecution of the Project and the potential impact of such work on Contractor’s schedule.

(e) Nothing herein contained shall be interpreted as granting to Contractor the exclusive occupancy at the site of Project. Contractor shall not cause any unnecessary hindrance or delay to any other contractor working on the Project Site. If execution of any contract by the District is likely to cause interference with Contractor’s performance of its contract, District shall decide which contractor shall cease work temporarily and which contractor shall continue, or whether work can be coordinated so that contractors may proceed simultaneously.

(f) District shall not be responsible for any damages suffered or extra costs incurred by Contractor resulting directly or indirectly from award or performance or attempted performance of any other contract or contracts at the Project, or caused by any decision or omission of District respecting the order of precedence in performance of contracts.

CONTRACTOR IS AWARE THAT THIS CONTRACT MAY BE SPLIT INTO SEVERAL PHASES. IF THE CONTRACT IS SPLIT INTO PHASES THEN CONTRACTOR HAS MADE ALLOWANCE FOR ANY DELAYS OR DAMAGES WHICH MAY ARISE FROM COORDINATION WITH CONTRACTORS FOR OTHER PHASES. IF ANY DELAYS SHOULD ARISE FROM ANOTHER CONTRACTOR WORKING ON A DIFFERENT PHASE, CONTRACTOR’S SOLE REMEDY FOR DAMAGES, INCLUDING DELAY DAMAGES, SHALL BE AGAINST THE CONTRACTOR WHO CAUSED SUCH DAMAGE AND NOT THE DISTRICT. CONTRACTOR SHALL PROVIDE ACCESS TO OTHER CONTRACTORS FOR OTHER PHASES AS NECESSARY TO PREVENT DELAYS AND DAMAGES TO OTHER CONTRACTORS WORKING ON OTHER PHASES OF CONSTRUCTION.

6.1.2 District’s Right to Carry Out the Work. See Paragraph 2.2.

6.1.3 Designation as Contractor.

When separate contracts are awarded to contractors on the Project Site, the term “Contractor” in the Contract Documents in each case shall mean the Contractor who executes each separate District/Contractor Agreement.

6.1.4 Contractor Duties.

The Contractor shall have overall responsibility to reasonably coordinate and schedule Contractor’s activities with the activities of the District’s own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the District in reviewing their construction schedules when directed to
do so. The Contractor shall make any revisions to the construction schedule and Contract Sum deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors, and the District until subsequently revised. Additionally, Contractor shall coordinate with Architect and District inspector to ensure timely and proper progress of work.

6.2 **CONSTRUCTIVE OWNERSHIP OF PROJECT SITE AND MATERIAL**

Upon commencement of Work, the Contractor becomes the constructive owner of the entire site, improvements, material and equipment on Project site. Contractor must ensure proper safety and storage of all materials and assumes responsibility as if Contractor was the owner of the Project site. All risk of loss or damage shall be borne by Contractor during the Work until the date of Completion. As construction owner, Contractor must carry adequate insurance in case of calamity and is not entitled to rely on the insurance requirements as set forth in this agreement as being adequate coverage in case of calamity.

6.3 **DISTRICT’S RIGHT TO CLEAN UP**

If a dispute arises among the Contractor, separate contractors, and the District as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish as described in Paragraph 3.12, the District may clean up and allocate the cost among those it deems responsible.

**ARTICLE 7 NOT USED**

**ARTICLE 8**

**TIME**

8.1 **DEFINITIONS**

8.1.1 Contract Time.

Contractor shall perform and complete all Work under this Contract within the time specified in the Agreement Form. Moreover, Contractor shall perform its Work in strict accordance with any completion schedule, construction schedule or Project milestones developed pursuant to the provisions of the Contract including, but not limited to the Project Schedule set forth in the Specifications.

8.1.2 Notice to Proceed.

District may give a notice to proceed within three (3) months of the award of the bid by District. Once Contractor has received the notice to proceed, Contractor shall complete the Work in the period of time referenced in the Contract Documents.
In the event that District desires to postpone the giving of the notice to proceed beyond this three-month period, it is expressly understood that with reasonable notice to the Contractor, the giving of the date to proceed may be postponed by District. It is further expressly understood by Contractor, that Contractor shall not be entitled to any Claim of additional compensation as a result of the postponement of the giving of the notice to proceed.

If the Contractor believes that a postponement will cause a hardship to Contractor, Contractor may terminate the contract with written notice to District within 10 days after receipt by Contractor of District’s notice of postponement. It is further understood by Contractor that in the event that Contractor terminates the Contract as a result of postponement by the District, the District shall only be obligated to pay Contractor for the Work that Contractor had performed at the time of notification of postponement. Should Contractor terminate the contract as a result of a notice of postponement, District shall have the authority to award the contract to the next lowest responsible bidder.

8.1.3 Computation of Time.

The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

The Contractor will only be allowed a time extension for unusually severe weather if it results in precipitation or other conditions which in the amount, frequency, or duration is in excess of the norm at the location and time of year in question as established by National Oceanic and Atmospheric Administration (NOAA) weather data. No less than the amount of work days allocated in Section 01305, Delay and Extensions to the Work, shall be allocated equally across the Contract Time, unless otherwise approved by the District, and will be identified as non-working weather days in the Contractor’s Baseline CPM Schedule for the entire Contract period of performance. The weather days shall be shown on the Baseline CPM Schedule and if not used will become float for the Project’s use. A day-for-day extension will only be allowed for those days in excess of the norm. The Contractor is expected to work seven (7) days per week (if necessary, irrespective of inclement weather), to maintain access, and to protect the Work under construction from the effects of inclement weather. If the weather is unusually severe and is in excess of the NOAA data norm and prevents the Contractor from beginning work at the usual daily starting time, or prevents the Contractor from proceeding with seventy-five (75%) of the normal labor and equipment force towards completion of the day’s current controlling item on the accepted schedule for a period of at least five hours, and the crew is dismissed as a result thereof, the Architect will designate such time as unavoidable delay and grant one (1) work-day extension.

8.2 HOURS OF WORK.

8.2.1 Sufficient Forces.

Contractors and Subcontractors shall continuously furnish sufficient forces to ensure the prosecution of the Work in accordance with the Construction Schedule.

8.2.2 Performance During Working Hours.
Work shall be performed during regular working hours as permitted by the appropriate governmental agency except that in the event of an emergency, or when required to complete the Work in accordance with job progress, Work may be performed outside of regular working hours with the advance written consent of the District and approval of any required governmental agencies.

8.2.3 Costs for After Hours Inspections.

If the Contract Documents require Work to be done outside the Inspector’s regular working hours, the costs of any after hour inspections, shall be borne by the District.

If the District allows the Contractor to do Work outside regular working hours for the Contractor’s convenience, or if required to maintain schedule, the costs of any inspections required outside regular working hours shall be invoiced to the Contractor by the District and deducted from the next Progress Payment.

If the Contractor elects to perform Work outside the Inspector’s regular working hours, costs of any inspections required outside regular working hours shall be invoiced to the Contractor by the District and deducted from the next Progress Payment.

8.3 PROGRESS AND COMPLETION.

8.3.1 Time of the Essence.

Time limits stated in the Contract Documents are of the essence to the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

8.4 EXTENSIONS OF TIME – LIQUIDATED DAMAGES

8.4.1 Liquidated Damages.

Contractor and District hereby agree that the exact amount of damages for failure to complete the Work within the time specified is extremely difficult or impossible to determine. If the Work is not completed within the time specified in the Contract Documents, it is understood that the District will suffer damage. It being impractical and unfeasible to determine the amount of actual damage, it is agreed the Contractor shall pay to District as fixed and liquidated damages, and not as a penalty, the amount specified in the Construction Agreement for each calendar day of delay in completion. Any liquidated damages recovered by the District shall not, however, limit the District’s right to separately recover any actual out-of-pocket damages it suffers due to Contractor’s delay. Contractor and his surety shall be liable for the amount thereof pursuant to Government Code section 53069.85.

8.4.2 Excusable Delay.
Contractor shall not be charged for liquidated damages because of any delays in completion of Work which are not the fault or negligence of Contractor or its subcontractors, including acts of God, as defined in Public Contract Code Section 7107, acts of enemy, epidemics and quarantine restrictions.

Contractor shall within five (5) calendar days of beginning of any such delay notify District in writing of causes of delay; thereupon District shall ascertain the facts and extent of delay and grant extension of time for completing Work when, in its judgment, the findings of fact justify such an extension. Extensions of time shall apply only to that portion of Work affected by delay, and shall not apply to other portions of Work not so affected. An extension of time may only be granted after proper compliance with the Specification Sections requiring preparation and submission of a properly prepared CPM schedule.

No extended overhead, general conditions costs, impact costs, out-of-sequence costs or any other type of compensation, by any name or characterization, shall be paid to the Contractor for any delay to any activity not designated as a critical path item on the latest approved Project schedule.

The Contractor shall notify the District in writing of any anticipated delay and its cause, in order that the District may take immediate steps to prevent, if possible, the occurrence or continuance of delay, and may determine whether the delay is to be considered avoidable or unavoidable, how long it continues, and to what extent the prosecution and completion of the Work might be delayed thereby.

In the event the Contractor requests an extension of Contract time for unavoidable delay, such request shall be submitted in accordance with the provisions in the Contract Documents governing changes in work. When requesting time, i.e., extensions, for proposed Change Orders, they must be submitted with the proposed Change Order with full justification and documentation. If the Contractor fails to submit justification with the proposed Change Order it waives its right to a time extension at a later date. Such justification must be based on the official Contract schedule as updated at the time of occurrence of the delay or execution of Work related to any changes to the scope of work. The justification must include, but is not limited to, the following information:

(a) The duration of the activity relating to the changes in the Work and the resources (manpower, equipment, material, etc.) required to perform these activities within the stated duration.

(b) Logical ties to the official Contract schedule for the proposed changes and/or delay showing the activity/activities in the schedule whose start or completion dates are affected by the change and/or delay. (A fragment of any delay of over ten (10) days must be provided.)

The Contractor and District understand and expressly agree that insofar as Public Contract Code Section 7102 may apply to changes in the Work or delays under this contract, the actual delays and damages, if any, and time extensions are intended to, and shall provide, the exclusive and full method of compensation for changes in the Work and construction delays.
8.4.3 Notice by Contractor Required.

The Contractor shall within five (5) calendar days of beginning of any such delay notify the District in writing of causes of delay with justification and supporting documentation. District will then ascertain the facts and extent of the delay and grant an extension of time for completing the Work when, in its judgment, the findings of fact justify such an extension. Extensions of time shall apply only to that portion of the Work affected by the delay and shall not apply to other portions of the Work not so affected. The sole remedy of Contractor for extensions of time under Paragraph 8.4.2 shall be an extension of the Contract Time at no cost to the District.

Claims relating to time extensions shall be made in accordance with applicable provisions of Specification Section 01250.

8.4.4 No Additional Compensation for Delays within Contractor’s Control

CONTRACTOR IS AWARE THAT GOVERNMENTAL AGENCIES, SUCH AS THE DEPARTMENT OF GENERAL SERVICES, GAS COMPANIES, ELECTRICAL UTILITY COMPANIES, WATER DISTRICTS AND OTHER AGENCIES MAY HAVE TO APPROVE CONTRACTOR PREPARED DRAWINGS OR APPROVE A PROPOSED INSTALLATION. CONTRACTOR HAS INCLUDED DELAYS AND DAMAGES WHICH MAY BE CAUSED BY SUCH AGENCIES IN CONTRACTOR’S BID. THUS, CONTRACTOR IS NOT ENTITLED TO MAKE CLAIM UPON THE DISTRICT FOR DAMAGES OR DELAYS ARISING FROM THE DELAYS CAUSED BY SUCH AGENCIES. FURTHERMORE, THE CONTRACTOR HAS SCHEDULED FOR SUCH DELAYS AND IS NOT ENTITLED TO AN Extension OF TIME FOR DELAYS CAUSED BY GOVERNMENTAL AGENCIES WHICH CONTRACTOR MUST OBTAIN APPROVALS FROM AND, THUS, CONTRACTOR IS NOT ENTITLED TO AN Extension OF TIME.

CONTRACTOR SHALL ONLY BE ENTITLED TO COMPENSATION FOR DELAY WHEN THE FOLLOWING CONDITIONS ARE MET: (1) THE DISTRICT IS RESPONSIBLE FOR THE DELAY; (2) THE DELAY IS UNREASONABLE UNDER THE CIRCUMSTANCES INVOLVED; AND (3) THE DELAY WAS NOT WITHIN THE CONTEMPLATION OF DISTRICT AND CONTRACTOR.

ARTICLE 9
NOT USED

ARTICLE 10
NOT USED

ARTICLE 11
INSURANCE AND BONDS

11.1 CONTRACTOR’S LIABILITY INSURANCE

11.1.1 Insurance Requirements

Before the commencement of the Work, the Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in California with a financial rating of at least an A-VIII status as rated in the most recent edition of Best’s Insurance...
Reports or as amended by the Supplementary General Conditions, such insurance as will protect the District from claims set forth below, which may arise out of or result from the Contractor’s Work under the Contract and for which the Contractor may be legally liable, whether such Work are by the Contractor, by a Subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. Any required insurance shall not contain any exclusion that applies to the type of work performed by the Contractor under the Contract Documents.

a. Claims for damages because of bodily injury, sickness, disease, or death of any person District would require indemnification and coverage for employee claim;

b. Claims for damages insured by usual personal injury liability coverage, which are sustained by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor or by another person;

c. Claims for damages because of injury or destruction of tangible property, including loss of use resulting therefrom, arising from operations under the Contract Documents;

d. Claims for damages because of bodily injury, death of a person, or property damage arising out of the ownership, maintenance, or use of a motor vehicle, all mobile equipment, and vehicles moving under their own power and engaged in the Work;

e. Claims involving contractual liability applicable to the Contractor’s obligations under the Contract Documents, including liability assumed by and the indemnity and defense obligations of the Contractor and the Subcontractors; and

f. Claims involving Completed Operations, Independent Contractors’ coverage, and Broad Form property damage, without any exclusions for collapse, explosion, demolition, underground coverage, and excavating. (XCU)

g. Claims involving sudden or accidental discharge of contaminants or pollutants.

11.1.2 Specific Insurance Requirements

Contractor shall take out and maintain:

1. Comprehensive General Liability Insurance with a combined single limit per occurrence of not less than $5,000,000.00 or Commercial General Liability Insurance which provides limits of not less than:

   (a) Per occurrence (combined single limit) $5,000,000.00
   (b) Project Specific Aggregate (for this Project only) $10,000,000.00
   (c) Products and Completed Operations (aggregate) $5,000,000.00
   (d) Personal and Advertising Injury Limit $1,000,000.00

2. Insurance Covering Special Hazards
The following Special hazards shall be covered by riders or riders to above mentioned public liability insurance or property damage insurance policy or policies of insurance, in amounts as follows:

(a) Automotive and truck where operated in amounts $1,000,000.00

(b) Material Hoist where used in amounts $1,000,000.00

(c) Explosion, Collapse and Underground (XCU coverage) $1,000,000.00

(d) Hazardous Materials $1,000,000.00

3. In addition, provide Excess Liability Insurance coverage in the amount of Four Million Dollars ($4,000,000.00).

11.1.3 Subcontractor Insurance Requirements

The Contractor shall require its Subcontractors, whether primary or secondary to take out and maintain public liability insurance and property damage insurance required under Paragraph 11.1.1. A “claims made” or modified “occurrence” policy shall not satisfy the requirements of Paragraph 11.1.1 without prior written approval of the District.

Contractor shall require all Subcontractors, if any, whether primary or secondary, to take out and maintain:

(a) Per occurrence (combined single limit) $5,000,000.00

$1,000,000.00

(b) Project Specific Aggregate (for this Project only) $2,000,000.00

(c) Products and Completed Operations (aggregate) $1,000,000.00

(d) Personal and Advertising Injury Limit $1,000,000.00

Insurance Covering Special Hazards

The following Special hazards shall be covered by riders or riders to above mentioned public liability insurance or property damage insurance policy or policies of insurance, in amounts as follows:

(a) Automotive and truck where operated in amounts $1,000,000.00

(b) Material Hoist where used in amounts $1,000,000.00

(c) Explosion, Collapse and Underground (XCU coverage) $1,000,000.00

(d) Hazardous Materials $1,000,000.00

11.1.4 Additional Insured Endorsement Requirements
The Contractor shall name, on any policy of insurance required under Paragraph 11.1, the District, CM, Architect, Inspector, the State of California, their officers, employees, agents, volunteers and independent contractors as additional insureds. Subcontractors shall name the Contractor, the District, Architect, Inspector, the State of California, their officers, employees, agents, volunteers and independent contractors as additional insureds. The Additional Insured Endorsement included on all such insurance policies shall be an ISO CG 20 10 (04/13), or an ISO CG 20 38 (04/13), or their equivalent as determined by the District in its sole discretion, and must state that coverage is afforded the additional insured with respect to claims arising out of operations performed by or on behalf of the insured. If the additional insureds have other insurance which is applicable to the loss, such other insurance shall be on an excess or contingent basis. The insurance provided by the Contractor pursuant to Paragraph 11.1 must be designated in the policy as primary to any insurance obtained by the District. The amount of the insurer’s liability shall not be reduced by the existence of such other insurance.

11.2 WORKERS’ COMPENSATION INSURANCE

During the term of this Contract, the Contractor shall provide workers’ compensation and employer’s liability insurance for all of the Contractor’s employees engaged in Work under this Contract or at the Site of the Project and, in case any of the Contractor’s Work is subcontracted, the Contractor shall require the Subcontractor to provide workers’ compensation insurance for all the Subcontractor’s employees engaged in Work under the subcontract. Any class of employee or employees not covered by a Subcontractor’s insurance shall be covered by the Contractor’s insurance. In case any class of employees engaged in Work under this Contract on or at the Site of the Project is not protected under the Workers’ Compensation laws, the Contractor shall provide or cause a Subcontractor to provide insurance coverage for the protection of those employees not otherwise protected. The Contractor shall file with the District certificates of insurance as required under Paragraph 11.6 and in compliance with Labor Code § 3700.

Workers’ compensation limits as required by the Labor Code, but not less than $1,000,000 and employers’ liability limits of $1,000,000 per accident for bodily injury or disease.

11.3 BUILDER’S RISK/ “ALL RISK” INSURANCE

11.3.1 Course-of-Construction Insurance Requirements

The Contractor, during the progress of the Work and until final acceptance of the Work by District upon completion of the entire Contract, shall maintain Builder’s Risk, Course of Construction or similar first party property coverage issued on a replacement cost value basis consistent with the total replacement cost of all insurable Work and the Project included within the Contract Documents. Coverage is to insure against all risks of accidental direct physical loss, and must include, by the basic grant of coverage or by endorsement, the perils of vandalism, malicious mischief (both without any limitation regarding vacancy or occupancy), fire, sprinkler leakage, civil authority, sonic boom, earthquake, flood, collapse, wind, lightning, smoke and riot. The coverage must include debris removal, demolition, increased costs due to enforcement of building codes.
ordinance and law in the repair and replacement of damage and undamaged portions of the property, and reasonable costs for the Architect’s and engineering services and expenses required as a result of any insured loss upon the Work and Project which is the subject of the Contract Documents, including completed Work and Work in progress, to the full insurable value thereof. Such insurance shall include the District and the Architect as additional named insureds, and any other person with an insurable interest as designated by the District.

The Contractor shall submit to the District for its approval all items deemed to be uninsurable. The risk of the damage to the Work due to the perils covered by the “Builder’s Risk/All Risk” Insurance, as well as any other hazard which might result in damage to the Work, is that of the Contractor and the Surety, and no Claims for such loss or damage shall be recognized by the District nor will such loss or damage excuse the complete and satisfactory performance of the Contract by the Contractor.

11.4 FIRE INSURANCE

Before the commencement of the Work, the Contractor shall procure, maintain, and cause to be maintained at the Contractor’s expense, fire insurance on all Work subject to loss or damage by fire. The amount of fire insurance shall be sufficient to protect the Project against loss or damage in full until the Work is accepted by the District. This requirement may be waived upon confirmation by the District that such coverage is provided under the Builder’s Risk Insurance being provided.

11.5 AUTOMOBILE LIABILITY

11.5.1 The District, Architect and Construction Manager, Inspectors, their directors, officers, employees, agents and volunteers shall be covered as additional insureds with respect to the ownership, operation, maintenance, use, loading or unloading of any auto owned, leased, hired or borrowed by the Contractor or for which the Contractor is responsible. Such insurance coverage shall be primary and non-contributory insurance as respects the District, Architect, Construction Manager, Project Inspector, their directors, officers, employees, agents and volunteers, or if excess, shall stand in an unbroken chain of coverage excess of the Contractor’s scheduled underlying coverage. Any insurance or self-insurance maintained by the District, Architect, Construction Manager, Project Inspector, their directors, officers, employees, agents and volunteers shall be excess of the Contractor’s insurance and shall not be called upon to contribute with it. The insurer shall agree to waive all rights of subrogation against the District, Architect, Construction Manager, Project Inspector, their directors, officers, employees, agents and volunteers for losses paid under the terms of the insurance policy that arise from Work performed by the Contractor.

11.5.2 Insurance Services Office Business Auto Coverage Form Number CA 0001, Code 1 (any auto) is required. Comprehensive Automobile Liability insurance to include all autos, owned, non-owned, and hired, with limits of $1,000,000 per accident for bodily injury and property damage.

11.6 OTHER INSURANCE
The Contractor shall provide all other insurance required to be maintained under applicable laws, ordinances, rules, and regulations.

11.7 PROOF OF INSURANCE

The Contractor shall not commence Work nor shall it allow any Subcontractor to commence Work under this Contract until all required insurance and certificates have been obtained and delivered in duplicate to the District for approval subject to the following requirements:

a. Certificates and insurance policies shall include the following clause:

“This policy and any coverage shall not be suspended, voided, non-renewed, canceled, or reduced in required limits of liability or amounts of insurance or coverage until notice has been mailed via certified mail to the District. Date of cancellation or reduction may not be less than thirty (30) days after the date of mailing notice.”

b. Certificates of insurance shall state in particular those insured, the extent of insurance, location and operation to which the insurance applies, the expiration date, and cancellation and reduction notices.

c. Certificates of insurance shall clearly state that the District and the Architect are named as additional insureds under the policy described and that such insurance policy shall be primary to any insurance or self-insurance maintained by District.

d. The Contractor and its Subcontractors shall produce a certified copy of any insurance policy required under this Section upon written request of the District.

11.8 COMPLIANCE

In the event of the failure of Contractor to furnish and maintain any insurance required by this Article 11, the Contractor shall be in default under the Contract. Compliance by Contractor with the requirement to carry insurance and furnish certificates or policies evidencing the same shall not relieve the Contractor from liability assumed under any provision of the Contract Documents, including, without limitation, the obligation to defend and indemnify the District and the Architect.

11.9 WAIVER OF SUBROGATION

Contractor waives (to the extent permitted by law) any right to recover against the District for damages to the Work, any part thereof, or any and all claims arising by reason of any of the foregoing, but only to the extent that such damages and/or claims are covered by property insurance and only to the extent of such coverage (which shall exclude deductible amounts) by insurance actually carried by the District.

The provisions of this Article are intended to restrict each party to recovery against insurance carriers only to the extent of such coverage and waive fully and for the benefit of each, any rights and/or claims which might give rise to a right of subrogation in any insurance carrier. The District and the Contractor shall each obtain in all policies of insurance carried by either of them, a waiver
by the insurance companies thereunder of all rights of recovery by way of subrogation for any
damages or claims covered by the insurance.

11.10 PERFORMANCE AND PAYMENT BONDS

11.10.1 Bond Requirements

Unless otherwise specified in the Supplemental Conditions, prior to commencing any portion of
the Work, the Contractor shall furnish separate Payment and Performance Bonds for its portion of
the Work which shall cover 100% faithful performance of and payment of all obligations arising
under the Contract Documents and/or guaranteeing the payment in full of all claims for labor
performed and materials supplied for the Work. All bonds shall be provided by a corporate Surety
authorized and admitted to transact business in California as sureties.

To the extent, if any, that the Contract Price is increased in accordance with the Contract
Documents, the Contractor shall, upon request of the District, cause the amount of the bonds to
be increased accordingly and shall promptly deliver satisfactory evidence of such increase to the
District. To the extent available, the bonds shall further provide that no change or alteration of
the Contract Documents (including, without limitation, an increase in the Contract Price, as
referred to above), extensions of time, or modifications of the time, terms, or conditions of
payment to the Contractor will release the Surety. If the Contractor fails to furnish the required
bonds, the District may terminate the Contract for cause.

11.10.2 Surety Qualification

Only bonds executed by admitted Surety insurers as defined in Code of Civil Procedure § 995.120
shall be accepted. Surety must be a California-admitted Surety and listed by the U.S. Treasury
with a bonding capacity in excess of the Project cost.

11.10.3 Alternate Surety Qualifications

If a California-admitted Surety insurer issuing bonds does not meet these requirements, the
insurer will be considered qualified if it is in conformance with § 995.660 of the California Code of
Civil Procedure and proof of such is provided to the District.

ARTICLE 12

UNCOVERING AND CORRECTION OF WORK

12.1 UNCOVERING OF WORK

12.1.1 Uncovering Work for Required Inspections.

If a portion of the Work is covered without Inspector or Architect approval or not in
compliance with the Contract Documents, it must, if required in writing by the Inspector or
the Architect, be uncovered for the Inspector’s or the Architect's observation and be replaced at the Contractor’s expense without change in the Contract Sum or Time.

### 12.1.2 Costs for Inspections not Required.

If a portion of the Work has been covered which the Inspector or the Architect has not specifically requested to observe prior to its being covered, the Inspector or the Architect may request to see such Work, and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncover and replacement shall, by appropriate Change Order, be charged to the District. If such Work is not in accordance with Contract Documents, the Contractor shall pay such costs unless the condition was caused by the District or a separate contractor, in which event the District shall be responsible for payment of such costs to the Contractor.

### 12.2 CORRECTION OF WORK

#### 12.2.1 Correction of Rejected Work.

The Contractor shall promptly correct the Work rejected by the Inspector or the District upon recommendation of the Architect as failing to conform to the requirements of the Contract Documents, whether observed before or after Completion and whether or not fabricated, installed, or completed. The Contractor shall bear costs of correcting the rejected Work, including additional testing, inspections, and compensation for the Inspector’s or the Architect’s services and expenses made necessary thereby.

#### 12.2.2 One-Year Warranty or Guaranty Corrections.

If, within one (1) years after the date of Completion of the Work or a designated portion thereof, or after the date for commencement of warranties and guaranties established under this Contract, or by the terms of an applicable special warranty or guaranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the District to do so unless the District has previously given the Contractor a written acceptance of such condition. This period of one (1) years shall be extended with respect to portions of the Work first performed after Completion by the period of time between Completion and the actual performance of the Work. This obligation under this Paragraph 12.2.2 shall survive acceptance of the Work under the Contract and termination of the Contract. The District shall give such notice promptly after discovery of the condition.

#### 12.2.3 District’s Rights if Contractor Fails to Correct.

If the Contractor fails to correct nonconforming Work within a reasonable time, the District may correct it, pursuant to Specification Section 01290.
ARTICLE 13
MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located.

13.2 SUCCESSORS AND ASSIGNS

The District and the Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to the other party hereto and to partners, successors, assigns, and legal representatives of such other party in respect to covenants, agreements, and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

13.3 WRITTEN NOTICE

In the absence of specific notice requirements in the Contract Documents, written notice shall be deemed to have been duly served if delivered in person to the individual, member of the firm or entity, or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

13.4 RIGHTS AND REMEDIES

3.4.1 Duties and Obligations Cumulative.

Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

3.4.2 No Waiver.

No action or failure to act by the Inspector, the District, or the Architect shall constitute a waiver of a right or duty afforded them under the Contract Documents, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.
13.5 TESTS AND INSPECTIONS

13.5.1 Compliance.

Tests, inspections, and approvals of portions of the Work required by the Contract Documents will comply with Title 24, and with all other laws, ordinances, rules, regulations, or orders of public authorities having jurisdiction.

13.5.2 Independent Testing Laboratory. (ADDENDUM #3)

The District will select and pay an independent testing laboratory to conduct all tests and inspections required by regulatory agencies. Selection of materials required to be tested shall be made by the laboratory, and not by the Contractor. All costs for all other tests shall be included in the Bid Price and shall be paid for by the Contractor. The Contractor will be responsible to reimburse the District for the cost differential (e.g., travel expenses, subsistence expenses, higher hourly rates, premium time for overtime hours or outside of normal work day hours, swing shifts), if any, for inspection and testing services required by regulatory agencies incurred outside of a hundred (100) mile radius from the Project Site, or if the Contractor requests inspection and testing services outside normal work day hours (eight hours/day) Monday through Fridays, which are typically between 7:00 am and 3:30 pm. The District will provide the Contractor with the invoice and deduct the cost differential from the next Progress Payment.

13.5.3 Advance Notice to Inspector.

The Contractor shall notify the Inspector a sufficient time in advance of its readiness for required observation or inspection so that the Inspector may arrange for same. The Contractor shall notify the Inspector a sufficient time in advance of the manufacture of material to be supplied under the Contract Documents which must, by terms of the Contract Documents, be tested in order that the Inspector may arrange for the testing of the material at the source of supply.

13.5.4 Testing Off-Site.

Any material shipped by the Contractor from the source of supply, prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said Inspector that such testing and inspection will not be required, shall not be incorporated in the Work.

13.5.5 Additional Testing or Inspection.

If the Inspector, the Architect, the District, or public authority having jurisdiction determines that portions of the Work require additional testing, inspection, or approval not included under Paragraph 13.5.1, the Inspector will, upon written authorization from the District, make arrangements for such additional testing, inspection, or approval. The District shall bear such costs except as provided in Paragraph 13.5.7.

13.5.6 Costs for Retesting.
If such procedures for testing, inspection, or approval under Paragraphs 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, the Contractor shall bear all costs arising from such failure, including those of re-testing, re-inspection, or re-approval, including, but not limited to, compensation for the Architect’s services and expenses. Any such costs shall be paid by the District, invoiced to the Contractor, and deducted from the next Progress Payment.

13.5.7 Costs for Premature Test.

In the event the Contractor requests any test or inspection for the Project and is not completely ready for the inspection, the Contractor shall be invoiced by the District for all costs and expenses resulting from that testing or inspection, including, but not limited to, the Inspector’s and Architect’s fees and expenses, and the amount of the invoice of shall be deducted from the next Progress Payment.

13.6 TRENCH EXCAVATION

13.6.1 Trenches Greater Than Five Feet.

Pursuant to Labor Code § 6705, if the Contract Price exceeds $25,000 and involves the excavation of any trench or trenches five (5) feet or more in depth, the Contractor shall, in advance of excavation, submit to the District or a registered civil or structural engineer employed by the District or Architect, a detailed plan showing the design of shoring for protection from the hazard of caving ground during the excavation of such trench or trenches.

13.6.2 Excavation Safety.

If such plan varies from the Shoring System Standards established by the Construction Safety Orders, the plan shall be prepared by a registered civil or structural engineer, but in no case shall such plan be less effective than that required by the Construction Safety Orders. No excavation of such trench or trenches shall be commenced until said plan has been accepted in writing by the District or by the person to whom authority to accept has been delegated by the District.

13.6.3 No Tort Liability of District.

Pursuant to Labor Code § 6705, nothing in this Article shall impose tort liability upon the District or any of its employees.

13.6.4 No Excavation Without Permits.

The Contractor shall not commence any excavation Work until it has secured all necessary permits including the required CAL OSHA excavation/shoring permit. Any permits shall be prominently displayed on the Site prior to the commencement of any excavation.

13.7 WAGE RATES, TRAVEL, AND SUBSISTENCE
13.7.1 Wage Rates.

Pursuant to the provisions of Article 2 (commencing at § 1720), Chapter 1, Part 7, Division 2, of the Labor Code, the District has obtained the general prevailing rate of per diem wages and the general prevailing rate for holiday and overtime work in the locality in which this public works project is to be performed for each craft, classification, or type of worker needed for this Project from the Director of the Department of Industrial Relations (“Director”). These rates are on file at the administrative office of the DISTRICT and are also available from the Director of the Department of Industrial Relations. Copies will be made available to any interested party on request. The Contractor shall post a copy of such wage rates at appropriate, conspicuous, weatherproof points at the Site.

Any worker employed to perform work on the Project, but such work is not covered by any classification listed in the published general prevailing wage rate determinations or per diem wages determined by the Director of the Department of Industrial Relations, shall be paid not less than the minimum rate of wages specified therein for the classification which most nearly corresponds to the employment of such person in such classification.

13.7.2 Holiday and Overtime Pay.

Holiday and overtime work, when permitted by law, shall be paid for at the rate set forth in the prevailing wage rate determinations issued by the Director of the Department of Industrial Relations or at least one and one-half (1½) times the specified basic rate of per diem wages, plus employer payments, unless otherwise specified in the contract documents or authorized by law.

13.7.3 Wage Rates Not Affected by Subcontracts.

The Contractor shall pay and shall cause to be paid each worker engaged in the execution of the Work on the Project not less than the general prevailing rate of per diem wages determined by the Director, regardless of any contractual relationship which may be alleged to exist between the Contractor or any Subcontractor and such workers.

13.7.4 Per Diem Wages.

The Contractor shall pay and shall cause to be paid to each worker needed to execute the Work on the Project per diem wages including, but not limited to, employer payments for health and welfare, pensions, vacation, travel time and subsistence pay as provided for in Labor Code §1773.1.

13.7.5 Forfeiture and Payments.

Pursuant to Labor Code §1775 and the District’s Labor Compliance Program, the Contractor shall forfeit to the District, not more than Fifty Dollars ($50.00) for each calendar day, or portion thereof, for each worker paid less than the prevailing wages rates as determined by the Director of the Department of Industrial Relations, for the work or craft in which the
worker is employed for any Work done under the Agreement by the Contractor or by any Subcontractor under it. The amount of the penalty shall be determined by the Labor Commissioner and shall be based on consideration of: (1) whether the Contractor or Subcontractor’s failure to pay the correct rate of per diem wages was a good faith mistake and, if so, the error was promptly and voluntarily correct upon being brought to the attention of the Contractor or Subcontractor; and (2) whether the Contractor or Subcontractor has a prior record of failing to meet its prevailing wage obligations. Further details regarding the enforcement of paying prevailing wage rates, reporting violations, withholding contract payments, forfeitures and hearing to review withholding of contract payments are set forth in the District’s Labor Compliance Program.

13.8 NOT USED

13.9 APPRENTICES

13.9.1 Apprentice Wages and Definitions.

All apprentices employed by the Contractor to perform services under the Contract shall be paid the standard wage paid to apprentices under the regulations of the craft or trade for which he or she is employed, and as determined by the Director of the Department of Industrial Relations, and shall be employed only at the craft or trade to which he or she is registered. Only apprentices, as defined in §3077 of the Labor Code, who are in training under apprenticeship standards that have been approved by the Chief of the Division of Apprenticeship Standards and who are parties to written apprenticeship agreements under Chapter 4 (commencing with §3070) of Division 3, are eligible to be employed under this Contract. The employment and training of each apprentice shall be in accordance with the apprenticeship standards and apprentice agreements under which he or she is training, or in accordance with the rules and regulations of the California Apprenticeship Council.

13.9.2 Employment of Apprentices.

Contractor agrees to comply with the requirements of Labor Code §1777.5. The Contractor awarded the Project, or any Subcontractor under him or her, when performing any of the Work under the Contract or subcontract, employs workers in any apprenticeable craft or trade, the Contractor and Subcontractor shall employ apprentices in the ratio set forth in Labor Code §1777.5. The Contractor or any Subcontractor must apply to any apprenticeship program in the craft or trade that can provide apprentices to the Project site for a certificate approving the contractor or subcontractor under the apprenticeship standards for the employment and training of apprentices in the area or industry affected. However, the decision of the apprenticeship program to approve or deny a certificate shall be subject to review by the Administrator of Apprenticeship. The apprenticeship program or programs, upon approving the Contractor or Subcontractor, shall arrange for the dispatch of apprentices to the Contractor or Subcontractor upon the Contractor’s or Subcontractor’s request. “Apprenticeable craft or trade” as used in this Article means a craft or trade determined as an apprenticeable occupation in accordance with the rules and regulations prescribed by the California
Apprenticeship Council. The ratio of work performed by apprentices to journeyman employed in a particular craft or trade on the Project shall be in accordance with Labor Code §1777.5.

13.9.3 Submission of Contract Information.

Prior to commencing work on the Project, the Contractor and Subcontractors shall submit contract award information to the applicable apprenticeship program(s) that can supply apprentices to the Project and make the request for the dispatch of apprentices in accordance with the Labor Code. The information submitted shall include an estimate of journeyman hours to be performed under the Contract, the number of apprentices proposed to be employed, and the approximate dates the apprentices would be employed. A copy of this information shall also be submitted to the District. Within 60 days after concluding work on the Project, the Contractor and Subcontractors shall submit to the District, if requested, and to the apprenticeship program a verified statement of the journeyman and apprentice hours performed on the Project.

13.9.4 Apprentice Fund.

The Contractor or any Subcontractor under him or her, who, in performing any of the Work under the Contract, employs journeymen or apprentices in any apprenticeable craft or trade shall contribute to the California Apprenticeship Council the same amount that the Director determines is the prevailing amount of apprenticeship training contributions in the area of the Project. The Contractor and Subcontractors may take as a credit for payments to the California Apprenticeship Council any amounts paid by the Contractor or Subcontractor to an approved apprenticeship program that can supply apprentices to the Project. The Contractor and Subcontractors may add the amount of the contributions in computing his or her bid for the Contract.

13.9.5 Prime Contractor Compliance.

The responsibility of compliance with Article 13 and §1777.5 of the Labor Code for all apprenticeable occupations is with the Prime Contractor. Any Contractor or Subcontractor that knowingly violates the provisions of this Article or Labor Code §1777.5 shall be subject to the penalties set forth in Labor Code §1777.7 and the District’s Labor Compliance Program.

13.10 ASSIGNMENT OF ANTITRUST CLAIMS

13.10.1 Application.

Pursuant to Government Code § 4551, in entering into a public works contract or a subcontract to supply goods, services, or materials pursuant to a public works contract, the Contractor or Subcontractor offers and agrees to assign to the District all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act, (15 U.S.C. § 15) or under the Cartwright Act (Chapter 2 [commencing with § 16700] of Part 2 of Division 7 of the Business and Professions Code), arising from the purchase of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to the
Contractor, without further acknowledgment by the parties. If the District receives, either through judgment or settlement, a monetary recovery for a cause of action assigned under Chapter 11 (commencing with § 4550) of Division 5 of Title 1 of the Government Code, the assignor shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the District any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the District as part of the bid price, less the expenses incurred in obtaining that portion of the recovery.

13.10.2 Assignment of Claim.

Upon demand in writing by the assignor, the District shall, within one (1) year from such demand, reassign the cause of action assigned pursuant to this Article if the assignor has been or may have been injured by the violation of law for which the cause of action arose and the District has not been injured thereby or the District declines to file a court action for the cause of action.

13.11 STATE AUDIT

Pursuant to and in accordance with the provisions of Government Code § 10532, or any amendments thereto, all books, records, and files of the District, the Contractor, or any Subcontractor connected with the performance of this Contract involving the expenditure of state funds in excess of Ten Thousand Dollars ($10,000.00), including, but not limited to, the administration thereof, shall be subject to the examination and audit of the Office of the Auditor General of the State of California for a period of three (3) years after final payment is made under this Contract. Contractor shall preserve and cause to be preserved such books, records, and files for the audit period.

13.12 STORM WATER POLLUTION PREVENTION PLAN

13.12.1 Application

This Section, and including other Contract Specifications related to Storm Water Pollution Prevention, addresses the preparation, implementation and monitoring of a Storm Water Pollution Prevention Plan (SWPPP) for the purpose of preventing the discharge of pollutants from the construction site. This includes the elimination of pollution discharges such as improper dumping, spills or leakage from storage tanks or transfer areas. When required or specified, the District will not issue a Notice to Proceed until Contractor has prepared and obtained approval of SWPPP from the District and the State Water Resources Control Board. The Contractor shall also secure a certification that the construction project has met all of the conditions of the State Construction General Permit (Order No. 2009-0009-DWQ) and comply with all applicable local, state and federal regulations governing storm water pollution prevention. See Section 01572, Storm Water Pollution Prevention Plan-Sites that Disturbs One or More Acres for additional requirements for District projects over one or more acres. See below for projects under one acre
13.12.2 References and Materials

- “Erosion and Sediment Control Field Manual” California Regional Water Quality Control Board (RWQCB)—San Francisco Bay Region.

Use materials of a class, grade and type needed to meet the performance described in the Field Manual and/or the BMP Handbook.

13.12.3 Preparation and Approval

The Contractor shall prepare the Storm Water Pollution Prevention Plan (SWPPP), when required or specified, to comply with storm water pollution regulations for project sites with storm water discharges associated with construction activity such as clearing or demolition, grading, excavation and other land disturbances. The SWPPP shall apply to all areas that are directly related to construction activity, including but not limited to staging areas, storage yards, material borrow areas, and access roads.

13.12.3.1 For project sites, new or existing, with land disturbance of 1 or more acres (or less than 1 acres if part of a common plan of development), the Contractor shall prepare and submit to the District the SWPPP for review and approval. Submittal shall be made by fulfilling all data and attachment requirements required by the California Storm Water Multiple Application and Report Tracking System – SMARTS web-based program.

13.12.3.2 Data required by the SMARTS program shall be entered into the SMARTS program and submitted in time for the District to file a Notice of Intent at least two weeks prior to the commencement of construction activities. Failure by the Contractor to fully schedule and comply with these requirements shall not entitle a claim for delay.

13.12.3.3 Where land disturbance is less than 1 acres, a SWPPP is not required. However, BMPs indicated in the BMP Handbook needed to prevent or minimize storm water pollution shall be submitted to the District and implemented at no extra cost to the District.

13.12.3.4 Within twenty days after Award of Contract by the District, the Contractor shall submit to the District one copy of the SWPPP for review. After the District’s approval, the Contractor shall provide approved copies of the SWPPP as follows: one copy each to the District’s Construction Inspector, District’s Construction Manager, District Architect, and District’s Civil Engineer.

13.12.4 Implementation

The Contractor shall implement the Storm Water Pollution Prevention Plan by doing the following:

(a) Install perimeter controls prior to starting other construction work at the site.
(b) Contain on-site storm water at the jobsite. Do not drain on-site water directly into the storm drain.

(c) Provide SWPPP and BMP implementation training for those responsible for implementing the SWPPP.

(d) Designate trained personnel for the proper implementation of the SWPPP.

(e) Revise the SWPPP to suit changing site conditions and instances when properly installed systems are ineffective.

(f) Maintain data required by the state permit and SMARTS program to ensure that all data is up to date, and that any change in conditions or personnel responsible for the SWPPP is current and compliant.

(g) At the end of Construction Contract.

i. Leave in place storm water pollution prevention controls needed for post-construction storm water management and remove those that are not needed as determined by the District. Thereafter, left-in-place controls will be maintained by the District.

ii. Provide Site Monitoring Reports, SWPPP revisions, Compliance Certifications and related documents to the District. Post-construction storm water operation and management plan as mentioned in the compliance certifications are considered to be in place at the end of the Construction Contract.

iii. Provide and upload all required data and documents required in the SMARTS web-based program to receive an approved Notice of Termination from the State.

13.12.5 Monitoring

The Contractor shall comply with all requirements of the State Construction General Permit (Order No. 2009-0009-DWQ). The Contractor shall conduct examination of storm water pollution prevention controls monthly, as well as before and after each storm event and once each 24-hour period during extended storm events to identify BMP effectiveness and implement repairs or BMP changes as soon as feasible. All maintenance related to a storm event should be completed within 48 hours of the storm event. The Contact shall also prepare and maintain, at the jobsite, a log of each inspection using Site Monitoring Report forms.

13.12.6 Liabilities and Penalties
(a) Review of the SWPPP and inspection logs by the District shall not relieve the Contractor from liabilities arising from non-compliance with storm water pollution regulations.

(b) Payment of penalties for non-compliance by the Contractor shall be the sole responsibility of the Contractor and will not be reimbursed by the District.

(c) Compliance with the Clean Water Act and storm water pollution regulations pertaining to construction activity is the sole responsibility of the Contractor. For any fine(s) levied against the District due to non-compliance by the Contractor, the District will deduct from the final payment due the Contractor the total amount of the fine(s) levied on the District, plus legal and associated costs.

**ARTICLE 14**

**TERMINATION OR SUSPENSION OF THE CONTRACT**

14.1 **TERMINATION BY THE CONTRACTOR FOR CAUSE**

14.1.1 **Grounds for Termination.**

The Contractor may terminate the Contract if the Work is stopped for a period of thirty (30) consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons performing portions of the Work for whom the Contractor is contractually responsible, for only the following reasons:

(a) Issuance of an order of a court or other public authority having jurisdiction; or

(b) An act of government, such as a declaration of national emergency.

14.1.2 **Notice of Termination.**

If one of the above reasons exists, the Contractor may, upon written notice of seven (7) additional days to the District, terminate the Contract and recover from the District payment for Work executed and for reasonable costs verified by the Architect with respect to materials, equipment, tools, construction equipment, and machinery, including reasonable overhead, profit, and damages.

14.2 **TERMINATION BY THE DISTRICT FOR CAUSE**

14.2.1 **Grounds for Termination.**

The District may terminate the Contractor and/or this Contract for the following reasons:
(a) Persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

(b) Persistently or repeatedly is absent, without excuse, from the job site;

(c) Fails to make payment to Subcontractors, suppliers, materialmen, etc.;

(d) Persistently disregards laws, ordinances, rules, regulations, or orders of a public authority having jurisdiction; or

(e) Otherwise is in substantial breach of a provision of the Contract Documents.

14.2.2 Notification of Termination.

When any of the above reasons exist, the District may, without prejudice to any other rights or remedies of the District and after giving the Contractor and the Contractor’s surety, if any, written notice of seven (7) days, terminate the Contractor and/or this Contract and may, subject to any prior rights of the surety:

(a) Take possession of the Project and of all material, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

(b) Accept assignment of Subcontracts. Contractor acknowledges and agrees that if the District (in its sole and absolute discretion) decides to takeover completion of the Project, the Contractor agrees to immediately assign all subcontracts to the District which the District has chosen to accept; and

(c) Complete the Work by any reasonable method the District may deem expedient, including contracting with a replacement contractor or contractors.

14.2.3 Payments Withheld.

If the District terminates the Contract for one of the reasons stated in Paragraph 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is complete. All costs associated with the termination and completion of the Project shall be the responsibility of the Contractor and/or its surety.

14.2.4 Payments Upon Completion.

If the unpaid balance of the Contract Sum exceeds costs of completing the Work, including compensation for professional services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the District. The amount to be paid to the Contractor, or District, as the case may be, shall be certified by the Architect upon application. This payment obligation shall survive completion of the Contract.

14.3 TERMINATION OF CONTRACT BY DISTRICT (CONTRACTOR NOT AT FAULT)
14.3.1 Termination for Convenience.

District may terminate the Contract upon fifteen (15) calendar days of written notice to the Contractor and use any reasonable method the District deems expedient to complete the project, including contracting with replacement contractor or contractors, if it is found that reasons beyond the control of either the District or Contractor make it impossible or against the District’s interest to complete the work. In such a case, the Contractor shall have no claims against the District except: (1) the actual cost for labor, materials, and services performed which may be documented through timesheets, invoices, receipts, or otherwise, and (2) ten percent (10%) profit and overhead, and (3) five percent (5%) termination cost of the total of items (1) and (2). Contractor acknowledges and agrees that if the District (in its sole and absolute discretion) decides to takeover completion of the Project, the Contractor agrees to immediately assign all subcontracts to the District which the District has chosen to accept.

14.3.2 Non-Appropriation of Funds/ Insufficient Funds.

In the event that sufficient funds are not appropriated to complete the Project or the DISTRICT determines that sufficient funds are not available to complete the Project, DISTRICT may terminate or suspend the completion of the Project at any time by giving written notice to the Contractor. In the event that the DISTRICT exercises this option, the DISTRICT shall pay for any and all work and materials completed or delivered onto the site for which value is received, and the value of any and all work then in progress and orders actually placed which cannot be canceled up to the date of notice of termination. The value of work and materials paid for shall include a factor of fifteen percent (15%) for the Contractor’s overhead and profit and there shall be no other costs or expenses paid to Contractor. All work, materials and orders paid for pursuant to this provision shall become the property of the DISTRICT. DISTRICT may, without cause, order Contractor in writing to suspend, delay or interrupt the Project in whole or in part for such period of time as DISTRICT may determine. Adjustment shall be made for increases in the cost of performance of the Agreement caused by suspension, delay or interruption.

14.4 Remedies Other Than Termination

If a default occurs, the District may, without prejudice to any other right or remedy, including, without limitation, its right to terminate the Contract pursuant to Article 14.2, do any of the following:

(a) Permit the Contractor to continue under this Contract, but make good such deficiencies or complete the Contract by whatever method the District may deem expedient, and the cost and expense thereof shall be deducted from the Contract Price or paid by the Contractor to the District on demand;

(b) If the workmanship performed by the Contractor is faulty or defective materials are provided, erected or installed, then the District may order the Contractor to remove the faulty workmanship or defective materials and to replace the same with
work or materials that conform to the Contract Documents, in which event the Contractor, at its sole costs and expense, shall proceed in accordance with the District’s order and complete the same within the time period given by the District in its notice to the Contractor; or

(c) Initiate procedures to declare the Contractor a non-responsible bidder for a period of two to five years thereafter.

All amounts expended by the District in connection with the exercise of its rights hereunder shall accrue interest from the date expended until paid to the District at the maximum legal rate. The District may retain or withhold any such amounts from the Contract Price. If the Contractor is ordered to replace any faulty workmanship or defective materials pursuant to Paragraph (b) above, the Contractor shall replace the same with new work or materials approved by the Architect and the District, and, at its own cost, shall repair or replace, in a manner and to the extent the Architect and the District shall direct, all work or material that is damaged, injured or destroyed by the removal of said faulty workmanship or defective material, or by the replacement of the same with acceptable work or materials. In no event shall anything in this Paragraph be deemed to constitute a waiver by the District of any other rights or remedies that it may have at law or in equity, it being acknowledged and agreed by the Contractor that the remedies set forth in this Paragraph are in addition to, and not in lieu of, any other rights or remedies that the District may have at law or in equity.

END OF SECTION 00700
SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01290 – “Payment Procedures”
B. Section 01310 – “Construction Scheduling”
C. Section 01312 – “Project Meetings”
D. Section 01330 – “Submittal Procedures”
E. Section 01400 – “Quality Control Requirements”
F. Section 01540 – “Site Security and Safety”
G. Section 01625 – “Product Options and Substitutions”
H. Section 01740 – “Warrantees and Guaranties”
I. Section 01770 – “Contract Closeout Procedures”
J. Section 01780 – “Project Record Documents”
K. Section 01810 – “General Commissioning Requirements”
L. Divisions 2 through 33 Sections for Summary of Work requirements for the work in those Sections.

1.3 WORK DESCRIPTIONS WITHOUT FORCE
A. All general descriptions and/or general summaries of the work noted in this section, or elsewhere within the Contract Documents, are without force and effect on the Contract Work described and indicated in detail the Construction Documents. These general descriptions and summaries are for general reference and descriptive purposes only and in no way offer the complete and concise description of all the Work required by the Contract Documents.

1.4 WORK COVERED BY CONTRACT DOCUMENTS
The Overall Project Summary consists of renovations to portions of the existing instructional buildings as well as the construction of a new 6000 SF Library and Learning Resource Center and site improvements. The Invitation to bid specifically addresses the scope related to Increment 2 Expansion and Renovation.

Increment 2 Work includes, but is not limited to:
- Renovations at the Learning Commons
• Renovations at the existing West Building for a new Café, including site improvements for a grease interceptor and trash/recycle/compost enclosure
• Accessibility upgrades to existing restrooms as needed
• Construction of a new 6600sf building – Library Learning Resource Center (LLRC)
• Site Improvement at the new LLRC, including subgrade preparations, rerouting of existing underground utilities, extension of utilities to serve the new buildings and landscape improvements

A. CONTRACTS

Perform the work under a single, fixed-price Contract.

1.5 WORK SEQUENCE

A. Construct work as shown in the Contract Documents. Coordinate Baseline CPM Schedule activities and construction operations with District and the Architect.

B. During construction operations, various adjoining areas will be occupied, and their functions maintained. Temporary construction separations such as walls for sound and dust control, as well as pathway barricades, signage and clearly marked temporary pedestrian path of travel detours will be required and provided by the contractor.

C. Scheduling of Contractor's use of the areas and times involved shall be determined in cooperation with the District. Notify the District a minimum of 10-days prior to commencement of work.

D. Construction activities shall be performed between the hours of 7AM and 5PM, Monday through Friday, unless otherwise required. No Work shall be performed outside the above hours without prior written authorization from the Construction Manager/Project Manager.

1.6 USE OF PREMISES

A. Contractor shall only use the premises for work, storage, staging areas, and vehicular parking as designated in the Contract Documents.

1.7 EXISTING AREA CONDITION SURVEY

A. Prior to commencement of work, jointly survey the existing area to be remodeled with the District and Architect, noting and recording existing damage such as cracks, sags, and other damage (on Site Plan/Floor Plans).

B. This record shall serve as a basis for determination of subsequent damage to these items due to settlement, movement, demolition, or Contractor’s operations.

C. Existing damage observed shall be marked and the official record of existing damage shall be signed by the parties making the survey.

D. Cracks, sags, and damage to the area and other items not noted in the original survey but subsequently observed shall be reported immediately to the Architect.

1.8 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The Drawings may not show all existing water, gas, electrical, and hot water lines, and other items known or suspected to exist in the area of the work.
B. Contractor shall locate these installations before proceeding with demolition or other operations which may cause damage, maintain them in service where appropriate, and repair damage caused by the performance of the Work, at no increase in the Contract Sum.

C. In addition to notification, if a structure or utility is damaged, take appropriate action as specified in the General Conditions.

1.12 USE AND OCCUPANCY OF WORK PRIOR TO ACCEPTANCE BY DISTRICT

A. The District may use and occupy the building before formal acceptance under the following conditions:

1. A Certificate of Substantial Completion shall be prepared and executed as provided in the Contract Documents. See Section 01770 Contract Closeout Procedures. The Certificate of Substantial Completion shall be accompanied by a written endorsement of the Contractor’s insurance carrier and surety permitting occupancy by the District during the remaining period of the work.

2. Occupancy by the District shall not be construed as being an acceptance of that part of the Work occupied.

3. The Contractor will not be held responsible for damage to the occupied part of the Work resulting from the District’s occupancy.

4. Occupancy by the District shall not be deemed to constitute a waiver of existing claims the District or Contractor may have against each other.


6. The District will pay for utility costs associated with occupancy during construction.

1.13 NOISE CONTROL

A. See Section 01416, Special Procedures, for Noise Control requirements.

1.14 PROTECTION OF EXISTING IMPROVEMENTS

A. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements indicated to remain in place.

B. Protect improvements on adjoining properties as well as those on the District’s property.

C. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skimming and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.

D. Restore any improvements damaged by this work to their original condition as acceptable to the District or other parties or authorities having jurisdiction.

1.15 HAZARDOUS MATERIALS

A. Asbestos or Hazardous Waste abatement is included in the Bid Documents.

1.16 MISCELLANEOUS PROVISIONS
A. Items shown or scheduled to be salvaged will remain the property of the District. Store as directed by the Project Manager.

PART 2 - PRODUCTS
Not Used.

PART 3 - EXECUTION
Not Used.

END OF SECTION 01010
SECTION 01050
FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01311 – “Project Management and Coordination”
C. Section 01572 – “Storm Water Pollution Prevention Plan”
D. Divisions 2 through 33 Sections for Field Engineering requirements for the work in those sections.

1.3 SUBMITTALS
A. Contractor shall submit name and address of Surveyor and professional Engineer to District and Architect for approval prior to their work on the Project.
B. On request of District and Architect, Contractor shall submit documentation to verify accuracy of field engineering work, at no additional cost to the District.
C. At completion of the Work, Contractor shall submit a certificate signed by a licensed engineer or surveyor certifying that all elevations and locations of improvements are in conformance with Contract Documents.

1.4 REQUIREMENTS
A. Contractor shall provide and pay for field engineering services by an engineer licensed in the State of California, required for the Project, including, without limitation:
   1. Survey work required in execution of the Project.
   2. Civil or other professional engineering services specified, or required to execute Contractor’s construction methods.

1.5 QUALIFICATIONS OF SURVEYOR OR ENGINEERS
A. Contractor shall only use a qualified licensed engineer or registered land surveyor, approved by the District.

1.6 SURVEY REFERENCE POINTS
A. Existing basic horizontal and vertical control points for the project are those designated on the Drawings.

B. Contractor shall locate and protect control points prior to starting Site Work and preserve all permanent reference points during construction. In addition, Contractor shall:
   1. Make no changes or relocation without prior written notice to District and Architect.
   2. Report to District and Architect when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
   3. Require surveyor to replace project control points based on original survey control that may be lost or destroyed.
   4. Contractor to locate and protect existing survey control and reference points.
   5. Control datum for survey is that indicated on Drawings.
   6. Protect survey control points prior to starting Site Work; preserve permanent reference points during construction.
   7. Promptly report to Architect, District, and Project Inspector the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
   8. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice.

1.7 PROJECT RECORD DOCUMENTS
   A. Maintain complete, accurate log of control and survey work as it progresses. Indicate dimensions, locations, angles, and elevations of construction and Site Work.
   B. Submit Record Documents under provisions of Section 01770

1.8 EXAMINATION
   A. Verify locations of survey control points prior to starting Work.
   B. Promptly notify Architect of any discrepancies discovered.

1.9 SURVEY REQUIREMENTS
   A. Provide field engineering services. Utilize recognized engineering survey practices.
   B. Establish a minimum of two permanent bench marks on Site, referenced to established control points. Record locations, with horizontal and vertical data, on Project Record documents.
   C. Establish lines and levels, locate and lay out by instrumentation and similar appropriate means:
      1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
      2. Grid or axis for structures.
      3. Building foundation, column locations, and ground floor elevations.
   D. Periodically verify layouts by same means.

1.10 QUALITY CONTROL

Contra Costa Community College District
Diablo Valley College
D-4002 SRC Increment 2 – Expansion & Renovation
A. Employ a professional Engineer of the discipline required for specific service on Project, licensed in the State of California.

B. Submit evidence of Engineer’s errors and omissions insurance coverage to District, in the form of a current Insurance Certificate.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 Contractor is responsible for meeting all applicable codes, OSHA, and other safety and shoring requirements.

3.2 Contractor is responsible for any re-surveying required by correction of nonconforming work with no additional cost to the District or its representatives.

END OF SECTION 01050
SECTION 01055  
CONFORMANCE SURVEYING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01330 – “Submittal Procedures”
C. Section 01050 – “Field Engineering”
D. Section 01780 – “Project Record Documents”
E. Division 2 through 33 Sections for Conformance Surveying requirements for the work in those Sections

1.3 SUMMARY
A. All necessary Project conformance surveying and Project layout Work shall be completed by a Land Surveyor currently licensed in the State of California, and be based on established site bench marks, monuments, lines and levels necessary for the Work covered by this Contract without additional cost to the District.
B. Scope of Work: Provide conformance surveying required for proper completion of the Work including, but not limited to:
   1. All applicable Project components.

1.4 SUBMITTALS
A. Contractor will be required to submit seven (7) hard copies, wet stamped and signed by the licensed Land Surveyor and one (1) electronic copy on CD of all conformance surveys for the Project.

PART 2 – PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 LAYING OUT THE WORK
A. Prior to beginning work, Contractor shall secure the electronic grading plan from the Architect. The Surveyor shall provide all conformance survey drawings both as-constructed spot elevations and compare these elevations to those on the Contract Documents for the same location. Contractor shall show the difference in these two numbers.
B. Accuracy to all Surveys provided in this section shall be to 0.01 feet.

END OF SECTION 01055
SECTION 01140
WORK RESTRICTIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in
this document, and provisions in the General Conditions and other Division 1 Specification
Sections shall apply to this Section without limitation.

1.2 SUMMARY OF WORK RESTRICTION REQUIREMENTS

A. Prior to the start of Work, Contractor shall familiarize itself with the Work Restrictions as they
relate to all Work required by the Contract Documents.

B. Temporary Work Activity Plan shall include:
   1. Full size drawing (36”x42”) of site plan showing the proposed locations and dimensions of
temporary facilities and activities, including but not limited to, all proposed trailers,
equipment and material storage areas on the Project Site; safe and ADA complaint access
(ingress/egress) for pedestrians and vehicles around the construction areas; proposed haul
routes; all temporary construction, and way-finding signage; temporary fenced area(s), noise
and safety barriers, and dust partitions; and temporary measures to maintain continuous
and uninterrupted code compliant use of all occupied and surrounding areas impacted by
construction activities. Identify any areas that require temporary paving for stabilization or
prevention of tracking of mud, and for ADA complaint ingress and egress. Indicate if the use
of supplemental or other staging areas might be required. Also see Section 01500 for
Temporary Facilities and Control for additional requirements.

   2. Contractor shall submit two (2) hard copies at the pre-construction meeting, and email
       Adobe PDF Format of the initial submittal of the Temporary Work Activity Plan for review by
       the District, Architect, and by personnel from the Campus (e.g., Buildings & Grounds, Police
       Department, and other representatives).

C. Contractor shall construct dust partitions and other barriers as required by specification section
01416 prior to the start of abatement or demolition activities, whichever may occur first, and
they must remain in place until the completion of that activity.

D. Contractor shall perform and complete all Temporary Work Activities to ensure the following:
   1. The continuous and uninterrupted use of all occupied areas or areas within buildings that
      require 24/7 utility services, including but not limited to the applicable power, data,
      telephone, waterline, fire alarm system, fire sprinkler system mechanical, HVAC, gas, storm,
      sewage, plumbing, and electrical systems serving these areas.

   2. Protection of students, staff, faculty and personnel in occupied areas and surrounding and
      adjacent areas from the hazards and dust associated with construction.

   3. The work areas, roads, parking lots, and streets are to be kept clear, clean, and free of loose
      debris, construction materials and partially installed work which would create a safety
      hazard or interfere with subcontractor and personnel duties and traffic. The Contractor shall
      sweep the areas clean at the end of each workday and make every effort to keep dust and
      noise to a minimum at all times.
4. Prior to starting work, the Contractor shall provide a proposed schedule of temporary interruptions or shutdown of any utility or electrical/mechanical systems to the District Representatives. The Contractor shall provide written request (5) working days prior to the desired time for the proposed interruption(s). Work shall be performed at times other than the Campus’s normal hours of operation, or as directed by the District’s Construction Manager. Temporary interruptions shall be completed prior to the start of the next business day at the Campus to maintain continuous and uninterrupted use of Campus facilities and utility systems.

1.3 SUMMARY OF WORK RESTRICTIONS

A. General: All Temporary Work Activities must be completed within the timelines, work shift times, and the scheduled time period as required by the Contract Documents. Comply with the following:

1. The Temporary Work Activity Plan shall be approved by the District prior to any Work starting on the Project Site.
2. Contractor shall have all temporary fencing, signage, ADA compliant pathways and other temporary measures described in Paragraph 1.2 above installed, operational and accepted by the District prior to starting demolition or other Work as applicable.

B. Time Related Work Restrictions within the Contract Time

1. Although the Contract Time is a total of 425 calendar days between the Notice to Proceed and Substantial Completion, as articulated in Section 00600, Construction Agreement, Work by the Contractor is restricted and limited to specific time periods at specific locations during this contract duration as follows:

1.1. All Work affecting Classrooms shall be coordinated with the College and sequenced to reduce impact to class schedules

1.2. Saturday and Sunday Work: Work on Saturday is allowed, with prior approval of the District, if needed to ensure continuous progress of the Work.

1.3. Sunday Work: Work on Sunday is not allowed, unless otherwise approved by the District.

2. The Contractor is responsible for its own means and methods to comply with these work restrictions, and to submit a schedule in accordance with Section 01310.

C. Other Project Requirements and Restrictions

1. The Contractor’s staging area for trailers, construction vehicles, construction equipment and materials are restricted to the area pre-approved by the District. Contractor is responsible for obtaining parking passes from the Police Services.

2. Due to limited vehicular access in the area of construction, the Contractor will provide a traffic control plan for approval by the Campus Police Department.

3. Material and equipment deliveries to the construction site shall be closely monitored and controlled by the Contractor to avoid any delays to other vehicles using these roads. The Contractor shall include delivery milestones in its Project CPM Schedule and provide written notice at least two (2) workdays to the District and to the Police Services for all deliveries.
Any material or equipment deliveries that could potentially delay traffic will have to be delivered after normal business hours, unless otherwise approved by the District.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

**A.** All labor, equipment, materials, and all other requirements shall be provided and will be the sole responsibility of the Contractor for execution of entire work described in this specification section.

**PART 3 - EXECUTION**

**3.1 MEANS AND METHODS OF CONSTRUCTION**

**A.** Contractor to provide and shall be responsible for any and all means and methods that will be constructed, implemented and/or maintained on the site for all work described above.

END OF SECTION 01140
SECTION 01250
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01010 – “Summary of Work”
B. Section 01310 – “Construction Scheduling”
C. Section 01311 – “Project Management and Coordination”
D. Section 01330 – “Submittal Procedures”
E. Section 01770 – “Contract Closeout Procedures”
F. Divisions 2 through 33 Sections for Contract Modification Procedures requirements for the work in those Sections

1.3 SUMMARY

A. Any change in scope of Work or deviation from Contract Documents including, without limitation, extra work, or alterations or additions to or deductions from the original Work, shall not invalidate the original Contract, and shall be performed under the terms and conditions of the Contract Documents.

B. Changes in the work generally will begin with Requests for Information (RFI), followed by a response from the District and/or Architect, and possibly a Request for Proposal (RFP), a Contractor Proposed Change Order (PCO), a negotiated Proposed Change Order, followed by a formal Change Order (CO) authorizing the Change in the Work. A Construction Directive (CD) may be used in the absence of agreement on the terms of the Chance in the Work.

1.4 CHANGES - No Changes Without Authorization

A. There shall be no change whatsoever in the drawings, specifications, or in the Work without a District executed Change Order, District executed Construction Change Directive, or District approved no cost order by the Architect for a minor change in the Work as herein provided.

B. District shall not be liable for the cost of any extra work or any substitutions, changes, additions, omissions, or deviations from the Drawings and Specifications unless the District’s Governing Board has authorized the same and the cost thereof approved in writing by Change Order or executed Construction Change Directive.

C. No extension of time for performance of the Work shall be allowed hereunder unless claim for such extension is made at the time changes in the Work are ordered, and such time duly adjusted in writing in the Change Order.
D. The provisions of the Contract Documents shall apply to all such changes, additions, and omissions with the same effect as if originally embodied in the Drawings and Specifications. Notwithstanding anything to the contrary in this Section, all Change Orders shall be prepared and issued by the Architect and shall become effective when executed by the District’s Governing Board, the Architect, and the Contractor.

E. Should any Change Order result in an increase in the Contract price, the cost of such Change Order shall be agreed to, in writing, in advance by Contractor and District and be subject to the monetary limitations set forth in Public Contract Code. In the event that Contractor proceeds with any change in Work without first notifying District and obtaining the Architect’s and District’s consent to a Change Order, Contractor waives any claim of additional compensation for such additional work.

CONTRACTOR UNDERSTANDS, ACKNOWLEDGES, AND AGrees THAT THE REASON FOR THIS NOTICE REQUIREMENT IS SO THAT DISTRICT MAY HAVE AN OPPORTUNITY TO ANALYZE THE WORK AND DECIDE WHETHER THE DISTRICT SHALL PROCEED WITH THE CHANGE ORDER OR ALTER THE PROJECT SO THAT SUCH CHANGE IN WORK BECOMES UNNECESSARY.

1.5 REQUEST FOR INFORMATION (“RFI”)

A. Definition: An RFI is a written request prepared by the Contractor requesting the Architect to provide additional information necessary to clarify or amplify an item which the Contractor believes is not clearly shown or called for in the drawings or specifications, or to address problems which have arisen under field conditions. The Contractor shall not submit an RFI to the District or the Architect if it pertains to a Subcontractor’s request for clarification of the Contractor’s Subcontract or contractor’s construction documents, or any other Contract Documents prepared by the Contractor.

B. Scope: The RFI shall reference all the applicable Contract Documents including specification section, detail, page numbers, drawing numbers, and sheet numbers, etc. The Contractor shall make suggestions and interpretations of the issue raised by the RFI. An RFI cannot modify the Contract Cost, Contract Time, or the Contract Documents. The Contractor shall use RFI format provided by the District.

1. The Contractor shall be responsible for Contractor and Subcontractor costs to implement and administer RFIs throughout the duration of the Project. The Contractor shall maintain an RFI log with all RFIs, including revisions, listed with a short description of the request, the date, the status, and the disposition of the RFI. Regardless of the number of RFIs submitted, the Contractor shall not be entitled to additional compensation.

2. The Contractor shall be responsible for both the District and District consultants costs, including the Architect, for answering RFIs if an RFI requests an interpretation or decision of a matter where the information sought is equally available to the party making such request, as determined by the District; at the District’s discretion, such costs may be deducted from progress payments or the final payment.

3. The Architect or the District may issue a Request for Proposal which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications. The Contractor shall then prepare and submit an estimate within seven (7) Calendar Days. If the Contractor fails or refuses to submit a Proposal within said seven (7) day period, the District’s Representative or the District shall determine the fair and
reasonable cost of the Work indicated in a Request for Proposal which shall be binding on the Contractor.

4. Supplemental Instruction or Bulletin: The Architect or the District may issue an Architect’s Supplemental Instruction (ASI) or Bulletin to the Contractor.
   a. If the Contractor is satisfied with the Supplemental Instruction or Bulletin and does not request change in Contract Sum or Contract Time, then the direction of the Work shall be executed without a Change Order.
   b. If the Contractor believes that the Supplemental Instruction or Bulletin results in a change in Contract Sum or Contract Time, then the Contractor shall notify the District in writing within five Calendar Days after receiving the response. If the District disagrees with the Contractor, then the Contractor may give notice of intent to submit a Claim as described in the General Conditions, and submit its Claim within five Calendar Days of the District’s response. If the District agrees with the Contractor, then the Contractor must submit a cost or time extension proposal within seven (7) Calendar Days of the District’s response to the RFI. The Contractor’s failure to deliver either the foregoing notice of Claim or proposal by the respective deadlines stated above shall result in waiver of the right to file a proposal or Claim.

C. The Contractor shall reference each RFI to an activity of the Construction Schedule and shall note time criticality of the RFI, indicating time within which a response is required. The Contractor’s failure to reference RFI to an activity on the Construction Schedule and note time criticality on the RFI shall constitute the Contractor’s waiver of any claim for time delay or interruption to the Work resulting from any delay in responding to the RFI. The Contractor must submit time critical RFIs at least seven (7) Days prior to the scheduled start date of the affected Work activity.

D. Response Time: The Architect must respond to a RFI in writing within a reasonable time, normally seven (7) days for routine RFIs, after receiving such request. If the Architect’s response results in a change in the Work, then such change shall be effected by a written CO or Construction Change Directive, if appropriate. If the Architect cannot respond to the RFI within a reasonable time, the Architect shall notify the Contractor, with a copy to the Inspector and the District, of the amount of time that will be required to respond. District or the Architect will endeavor to respond within five (5) working Days from receipt of RFI with a written response to the Contractor, provided that the RFI complies with the paragraph above and is determined by the Architect or District to be time critical. Failure of the Contractor to plan ahead or mitigate problems shall not be cause for a determination that an RFI is time critical. The District or the Architect may return an RFI requesting additional information should the original RFI be incomplete or inadequately describe the information requested or conditions encountered. The Contractor shall distribute responses to all appropriate Subcontractors.
E. If the Contractor is satisfied with the response and does not request a change in Contract Sum or Contract Time, then the response shall be executed without a change.

F. Only the Contractor and/or the District may initiate changes in the scope of Work or deviation from Contract Documents.

1. Contractor may initiate changes by submitting an RFI or a letter providing Notice of Concealed or Unknown Conditions, or Notice of Hazardous Waste Conditions.
   a. RFIs shall be submitted to seek clarification of or request changes in the Contract Documents. RFIs shall not be submitted to the District seeking clarification of any errors or omissions on behalf of the Contractor’s preparation of the construction documents or any other Contract Documents prepared by the Contractor.
   b. Differing Site Conditions: The Contractor shall submit a Notice of Differing Site Conditions by RFI to resolve problems regarding differing conditions encountered in the execution of the Work pursuant to General Conditions, which shall govern. If the District and the Architect determine that a change in Contract Sum or Contract Time is justified, the District and the Architect will issue RFP or CCD.
   c. Hazardous Waste Conditions: The Contractor shall submit Notices of Hazardous Waste Conditions by RFI to resolve problems regarding undocumented hazardous materials encountered in the execution of the Work pursuant in General Conditions, which shall govern. If the District and the Architect determine that a change in Contract Sum or Contract Time is justified, the District and the Architect will issue RFP or CCD.

2. The Contractor may submit to the Architect a written Request for Information (RFI) if one of the following conditions occurs:
   a. Contractor discovers what appears to be an unforeseen condition or circumstance that is not described in the Contract Documents.
   b. The Contractor discovers what appears to be a conflict or inconsistency within the Contract Documents and the intent of the Contract Documents cannot be reasonably inferred.
   c. The Contractors discovers what appears to be an error or omission in the Contract Documents and the intent of the Contract Documents cannot be reasonably inferred.
   d. The Contractor considers a portion of the Contract Documents is not sufficiently explained or detailed for the Contractor to proceed with that portion of the Work.
   e. The Contractor who, after a full search of the Contract Documents and upon exercising required due diligence, fails to locate the required information.

G. If the Contractor believes that the RFI response results in Change in the Contract Sum or the Contract Time, the Contractor shall notify the District in writing within five calendar Days after receiving the response. If the District disagrees with the Contractor, then the Contractor may give notice of intent to submit a Claim as described in General Conditions, and submit its Claim within 30 Calendar Days of the District’s response. If the District agrees with the Contractor, then the Contractor must submit a cost or time extension proposal within fourteen (14) Calendar Days of the District’s response to the RFI. The Contractor’s failure to
deliver either the foregoing notice of Claim or proposal by the respective deadlines stated above shall result in waiver of the right to file a proposal or Claim.

H. Contractor shall identify RFIs with sequential numbering (i.e. 001, 002, 003 etc.) with a separate number assigned to each RFI. Resubmittal of apparent unresolved RFI issues shall be on a new RFI form with the initial RFI number amended with a sequential Revision suffix (.R1, .R2, .R3 etc.) until the issue is resolved.

I. Unless otherwise directed by the Project Manager, the Contractor shall submit each RFI on the form required by the District.
1. The Contractor shall fill in all required information. Include additional information, data, sketches and the like on separate sheets as necessary; limit sheet size to 8-1/2 by 11 inches if possible. RFIs without all required information may be returned without action to the Contractor for resubmittal. Resubmittal in accordance with the specified requirements shall be the Contractors’ responsibility.

2. The Contractors own proposed form may be used, if in the Project Manager’s judgment, it is equal to the form required by the District and it contains all pertinent information.

J. In each request, include the following information, type or printed legibly in block letters with black ink:
1. Project name as it appears on the Contract Documents
2. Contractor’s RFI identification number.
3. Title of issue.
5. Description of issue.
6. Contractor’s proposed written and graphic solution, Architect will determine if the proposal is in compliance with the Contract Documents and design intent of Project. Contractor’s failure to make reasonable effort to propose realistic solutions may result in the Request for Information being returned with no action.
7. Date of submission to Architect.
8. Date that response is needed to avoid impact to Construction schedule and cost. Time for response shall be reasonable to allow for processing and review, research, and written response by the appropriate party.
9. Urgency (normal or high).
10. Justification for high urgency.
11. Contractors’ name and the printed name and signature of Contractors’ representative responsible for issuance of request.
12. Name (individual and company) of responsible for originating RFI and his or her relationship to the Contractor.
13. Photographic image of condition. Furnish digital image if possible.
14. Photocopy of Contract Documents or sketch of condition (with dimensions) that pertains to this issue.
K. Limit each RFI to a single subject or issue. RFIs with multiple subject or issues may be returned to the Contractor without response. Resubmittal in accordance with the specified requirements shall be the Contractor’s responsibility.

L. Transmit each RFI to the District Project Manager as necessary to expedite the Project and to allow adequate time for review without delay to the Work. Do not transmit RFIs directly to the Architect, Architect’s Consultants, or others.

M. RFIs that do not meet the requirements of this Section will be returned to the Contractor with an explanation for its return.

N. Inappropriate RFIs, as described hereinafter, will be returned to the Contractor with an explanation for its return but without further action:
   1. RFIs that are received by the Architect from an entity other than the Contractor (such as a Subcontractor, Sub-subcontractor, supplier or others.)
   2. RFIs that transmit or contain a request for a substitution.
   3. RFIs that transmit or constitute a submittal.
   4. RFIs that are submitted without the Contractors’ thorough review of the Contract Documents or in a manner that suggests that specific portions of the Contract Documents are assumed to be excluded or taken as an isolated portion of the Contract Documents in part rather than whole.
   5. RFIs that are submitted in an untimely manner without adequate coordination or scheduling of the Work or related trades.
   6. RFIs that are submitted as a proposed or requested Change Order or other Contract Modification.
   7. RFIs that do not constitute a good faith request for required information.

O. Contractor shall be responsible for resubmittal of information contained in inappropriate RFIs in accordance with the requirements of the appropriate portion of the Contract Documents.

P. If information requested by the Contractor in an RFI is apparent from field observations, is contained in the Contract Documents, or can be reasonably inferred from them, the Contractor shall be responsible to the District for all reasonable fees charged by the Architect for additional services required to furnish such information. The amount of such additional services will be deducted from the Contractor’s next payment application by the District and those funds will be forwarded to the Architect as compensation.

Q. The quantity of RFIs submittal by the Contractor shall not be the basis for any claim by the Contractor.

R. Should the Contractor proceed with Work affect by an RFI issue before receipt of a written response from the Architect within the time described hereinbefore, that portion of the Work not performed in accordance with the requirements of the response shall be subject to the removal and replacement by the Contractor at no increase in Contract Sum or Contract Time.

S. Maintain a current and accurate Request for Information Log as follows:
   1. For each RFI, include the RFI number, subject matter, date submitted, date returned. Maintain current status of each RFI at all times.
   2. Submit log weekly and as requested by Project Manager or Architect.
3. Accurately maintain log for the duration of the Contract.

1.6 REQUEST FOR PROPOSAL (“RFP”)

A. Definition: An RFP is a written request prepared by the Architect requesting the Contractor to submit to the District and the Architect an estimate of the effect of a proposed change on the Contract Price and the Contract Time.

B. Scope: An RFP shall contain adequate information, including any necessary drawings and specifications, to enable Contractor to provide the cost breakdowns required by this Specification Section. The Contractor shall not be entitled to any Additional Compensation for preparing a response to an RFP, whether ultimately accepted or not.

C. District Requested RFP: the Contractor shall furnish a proposal within fourteen (14) Calendar Days of the District’s RFP. Upon approval of RFP, the District will issue a PCO directing the Contractor to proceed with the extra Work. If the parties do not agree on the price for an RFP, the District may issue a CCD. Upon receipt of CCD, the Contractor shall promptly proceed with the change of Work involved and concurrently respond to the District’s CCD within seven (7) Calendar Days. The Contractor shall perform the changed Work notwithstanding any claims or disagreements of any nature.

1.7 PROPOSED CHANGE ORDER (PCO) REQUEST

A. Definition: A PCO is a written request prepared by the Contractor requesting that the District and the Architect issue a CO based upon a proposed change called for in an RFP or a claim pursuant to the General Conditions.

B. Changes in Price: A PCO shall include breakdowns per this specification section to validate any change in Contract Price due to proposed change or claim.

C. Changes in Time: A PCO shall also include any additional time required to complete the Project. Any additional time requested shall not be the number of days to make the proposed change, but must be based upon the impact to the Project Schedule as defined in the Construction Scheduling Specifications of these Contract Documents. Any changes in time will be granted only if there is an impact to the critical path. If contractor fails to request a time extension in a PCO, then the Contractor is thereafter precluded from requesting or claiming a delay.

D. The Contractor may propose changes by submitting a Proposed Change Order (PCO form, see section 01340) to the District’s Representative, describing the proposed change and its full effect on the Work. The Contractor shall include a statement describing the reason for the change and the effect on the Contract Sum and Contract Time with full documentation including detailed cost and schedule breakout, and a statement describing the effect on Work by separate or other the Contractors. Document any requested substitutions in accordance with the Contract Documents. Cost for Work in approved PCOs shall not be applied for by the Contractor or paid by the District until the PCOs are included in a Change Order (CO form, see section 01340).

E. Cost Proposal and Procedures: Whenever the Contractor is required in this Section to prepare a Proposed Change Order form (PCO), and whenever the Contractor is entitled to submit a cost proposal and elects to do so, the Contractor shall prepare and submit to the District and the Architect for consideration a proposal using the PCO form found in the Contract Documents, or other similarly prepared form previously approved by the District. All cost proposals must
contain detailed line-item backup with a complete breakdown of costs for credits, deducts and extras, which itemizes materials, labor, equipment, taxes, overhead and profit. All Subcontractor Work shall be so indicated. Subcontractor quotes for any subcontractor tier submitted as lump sum or without the required line-item breakdown will be rejected. After receipt of a proposal with a detailed breakdown, the District and the Architect will act promptly thereon.

1. If the District and the Architect approves a proposal, the PCO will be routed for Contractor signatures, the District Representative signatures, and the District signature.

2. If a proposal is not acceptable to the District or the Architect because it does not agree with costs and/or time included in the proposal, the District or the Architect will submit in a response what it believes to be a reasonable cost and/or adjustment, if any. Except, as otherwise provided in this Section, the Contractor shall have five Calendar Days in which to respond to the District with a revised proposal.

3. When necessity to proceed with a change does not allow the District sufficient time to conduct a proper cost and schedule analysis of a proposal (or revised proposal), the District may direct the Contractor to proceed on a basis to be determined at earliest practical date. In this event, the value of the Change, with corresponding equitable adjustment to Contract, shall not be more than the increase or less than the decrease initially proposed.

1.8 CHANGE ORDERS (“CO”)

A Change Order is a written instrument prepared by the Architect and signed by the District (as authorized by the District’s Governing Board), the Contractor, the Architect, and the DSA (if necessary), stating their agreement upon all of the following:

A. A description of a change in the Work;
B. The amount of the adjustment in the Contract Sum, if any; and
C. The extent of the adjustment in the Contract Time, if any.
D. Change Order Forms: Whether or not noted on the executed form of Change Order, all Change Orders approved by the District are deemed to include and incorporate the following provision:

“The adjustment of the Contract Price and the Contract Time for the changes noted in a Change Order (the “Changes”) represents the full and complete adjustment of the Contract Price and the Contract Time due the Contractor for providing and completing such Changes, including without limitation: (i) all costs (whether direct or indirect) for labor, equipment, materials, tools, supplies and/or services; (ii) all general and administrative costs (including without limitation, home office, field office and Site General Conditions costs) and profit; and (iii) all impacts, delays, disruptions, interferences or hindrances in providing and completing the Changes. The Contractor waives all rights, including without limitation, those arising under Civil Code Section 1542, for any other adjustment of the Contract Price or the Contract Time on account of a Change Order or the performance and completion of the Changes.”
E. Correlation of Other Items

1. Contractor shall promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum as shown on the Change Order prior to the last day of the next monthly pay period.

2. Within seven (7) days, Contractor shall promptly revise Progress schedules, look ahead schedules, and the Contractors Master Schedule to reflect any Change in Contract Time, revise sub schedules to adjust times for other items of work affected by the change and resubmit to the District for review and approval. The Contractors shall not make changes to tasks in any schedule not impacted by the Change.

3. Contractor is responsible to promptly enter Changes in Project Record Documents.

F. All Changes:

1. Documentation of Change in Contract Sum and Contract Time:
   a. Contractor shall maintain detailed records of all Work performed on a time-and-material basis.
   b. Contractor shall document each proposal for a change in cost or time with sufficient data to allow detailed line item evaluation and analysis of the proposal.
   c. Contractor shall, on request, provide additional data to support computations for:
      i) Quantities of products, materials, labor and equipment.
      ii) Taxes, insurance, and bonds.
      iii) Overhead and profit.
      iv) Justification for any change in Contract Time and new Progress Schedule showing revision due, if any. Justification for change shall comply with Construction Scheduling Section 01310.
      v) Credit for deletions from Contract, similarly documented.
   d. Contractor shall support each claim for additional costs and for Work performed under Force Account with additional information including:
      i) Credit for deletions from Contract, similarly documented.
      ii) Origin and date of claim.
      iii) Dates and times Work was performed and by whom.
      iv) Time records and wage rates paid.
      v) Invoices and receipts for products, materials, equipment and subcontracts, similarly documented.

G. COST OF CHANGE ORDERS

1. It is the responsibility of the Contractor to notify the District within five Calendar Days if there is a cost change related to a change in the Work. Notification beyond this time limit may result in future claims being time barred.

2. Within seven (7) Calendar days after a request is made for a change that impacts the Contract Sum, the critical path, or the Contract Time, the Contractor shall provide the District and the Architect, with a written estimate of the effect of the proposed CO upon the Contract Sum and the actual cost of construction, which shall include a complete itemized cost breakdown of all labor and material showing actual quantities, hours, unit
prices, and wage rates required for the change, and the effect upon the Contract Time of such CO. Changes may be made by District by an appropriate written CO, or, at the District’s option, such changes shall be implemented immediately upon the Contractor’s receipt of an appropriate written Construction Change Directive.

3. District may, as provided by law and without affecting the validity of this Agreement, order changes, modification, deletions and extra work by issuance of written CO or Construction Change Directives from time to time during the progress of the Project, contract sum being adjusted accordingly. All such work shall be executed under conditions of the original Agreement except that any extension of time caused thereby shall be adjusted at time of ordering such change. District has discretion to order changes on a “time and material” basis with adjustments to time made after Contractor has justified through documentation the impact on the critical path of the Project.

4. The amount of the increase or decrease in the Contract Price from a CO, if any, shall be determined in one or more of the following ways as applicable to a specific situation:
   a. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation. If an agreement cannot be reached within fifteen (15) days after submission and negotiation of Contractor’s proposal, Contractor may submit a properly formatted claim per the General Conditions and this Specification Section. Submission of sums which have no basis in fact are at the sole risk of Contractor and may be a violation of the False Claims Act set forth under Government Code Section 12650 et. seq.);
   b. By unit prices contained in Contractor’s original bid and incorporated in the Project documents or fixed by subsequent agreement between District and Contractor;
   c. Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee. However, in the case of disagreement, Contractor must utilize the procedure under this Specification Section; or
   d. By cost of material and labor and percentage of overhead and profit. (Force Account)

H. COST DETERMINATION

1. Total cost of extra Work or of Work omitted shall be the sum of construction labor costs, material costs, equipment rental costs, as defined herein plus overhead and profit as allowed herein and by the General Conditions. This limit applies in all cases of claims for extra Work, whether calculating cost proposals, Change Orders or CCDs, or calculating claims of all types, and applies even in the event of fault, negligence, strict liability, or tort claims of all kinds, including strict liability or negligence. The Contractor may recover no other costs arising out of or connected with the performance of extra Work, of any nature. No special, incidental or consequential damages may be claimed or recovered against the District, its representatives or agents, whether arising from breach of contract, negligence or strict liability, unless specifically authorized in the Contract Documents.

2. Application of Overhead and Profit: (Overhead shall be as defined in this Specification Section.)
   a. Total overhead and profit on labor for extra Work shall not exceed 15 percent.
   b. Total overhead and profit on materials for extra Work shall not exceed 15 percent.
   c. Total overhead and profit on equipment for extra Work shall not exceed 10 percent.
d. When extra Work is performed by a first tier Subcontractor the Contractor shall receive a 5 percent markup on Subcontractors’ total costs of extra Work. First tier Subcontractor’s markup on its Work shall not exceed 15 percent.

e. When extra Work is performed by a lower tier Subcontractor, the Contractor shall receive a total of 5 percent markup on the lower tier Subcontractors’ total costs of extra Work. First tier Subcontractors and lower tier Subcontractors shall divide the 15 percent markup as mutually agreed.

f. Notwithstanding the foregoing, in no case shall the total markup on any extra Work exceed 20 percent of the direct cost, notwithstanding the actual number of contract tiers.

g. On proposals covering both increases and decreases in Contract Sum, overhead and profit shall be allowed on the net increase only as determined in paragraph 1.5 above. When the net difference is a deduction, no percentage for overhead and profit shall be allowed, but rather the deduction shall apply.

h. No markup will be allowed on permits, fees, insurance, and bonds.

I. Taxes: All State sales and use taxes, Contra Costa County and applicable City sales taxes, shall be included. Federal and Excise tax shall not be included.

J. Accord and Satisfaction: Every Change Order and accepted CCD shall constitute a full accord and satisfaction, and release, of all the Contractor (and if applicable, Subcontractor) claims for additional time, money or other relief arising from or relating to the subject matter of the change including, without limitation, impacts of all types, cumulative impacts, inefficiency, overtime, delay and any other type of claim. The Contractor may elect to reserve its rights to disputed claims arising from or relating to the changed Work at the time it signs a Change Order or approves a CCD, but must do so expressly in a writing delivered concurrently with the executed Change Order or approved CCD, and must also submit a Claim for the reserved disputed items pursuant to the General Conditions no later than 30 Calendar Days of the Contractor’s first written notice of its intent to reserve rights.

K. COST BREAKDOWN

1. Labor: the Contractor will be paid cost of labor for workers (not including the project superintendent, or forepersons unless forepersons work greater than 50% of the time and then only when authorized by the District), used in actual and direct performance of extra Work. Labor rate, whether employer is the Contractor, Subcontractor or other forces, will be sum of following:
   a. Actual Wages: Actual wages paid shall include any employer payments to or on behalf of workers for health and welfare, pension, vacation, and similar purposes.
   b. Labor surcharge: Payments imposed by local, county, state, and federal laws and ordinances, and other payments made to, or on behalf of, workers, other than actual wages such as taxes and worker’s compensation insurance. Such labor surcharge shall not exceed that set forth in the Prevailing Wage schedule which is in effect on date upon which extra Work is accomplished and which schedule is incorporated herein by reference as though fully set forth herein.
   c. If agreement cannot be reached between the District and Contractor, or its subcontractors regarding labor productivity rates then Saylor Publications Current Construction Costs, which is in effect on date upon which extra work is performed,
and which is incorporated herein by reference, shall be used to determine rates and surcharges. Unless accepted in writing by the District’s Representatives, other manuals, including NECA (National Electrical Contractors Association) manual, shall NOT be used as a basis to determine labor rates, labor productivity rates, labor surcharges, or any other costs.

2. Material: Only materials furnished and installed in the Work by the Contractor and necessarily used in performance of extra Work will be paid for. The Contractor and any and all subcontractors will submit proof of material cost satisfactory to the District when requested. Cost of such materials will be cost, including sales tax, to purchaser (Contractor, Subcontractor or other forces) from supplier thereof, except as the following are applicable:

   a. If cash or trade discount by actual supplier is offered or available to purchaser, it shall be credited to the District notwithstanding fact that such discount may not have been taken.

   b. For materials salvaged upon completion of extra Work, salvage value of materials shall be deducted from cost, less discounts, of materials.

   c. If cost of a material is, in opinion of the District, excessive, then cost of material shall be deemed to be lowest current wholesale price at which material is available in quantities concerned delivered to Site, less any discounts as provided in this Specification Section.

Unless accepted in writing by the District’s Representative, NECA (National Electrical Contractors Association) manual shall NOT be used as a basis to determine any material costs.

3. Equipment Rental: For the Contractor- or Subcontractor-owned equipment, payment will be made at rental rates listed for equipment in California Department of Transportation official equipment rental rate schedule which is in effect on date upon which extra Work is accomplished and which schedule is incorporated herein by reference as though fully set forth herein.

   a. If there is no applicable rate for an item of equipment, then payment shall be made for the Contractor- or Subcontractor-owned equipment at rental rate listed in the most recent edition of the Association of Equipment Distributors (AED) book.

   b. For rented equipment, payment will be made based on actual rental invoices. Equipment used on extra Work shall be of proper size and type. If, however, equipment of unwarranted size or type and cost is used, cost of use of equipment shall be calculated at rental rate for equipment of proper size and type, as determined by the District.

   c. Rental rates paid shall be deemed to cover cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, and all incidentals. Unless otherwise specified, manufacturer’s ratings, and manufacturer-approved modifications, shall be used to classify equipment for determination of applicable rental rates.

   d. Individual pieces of equipment or tools not listed in said publication and having a replacement value of $250 or less, whether or not consumed by use, shall be
considered to be small tools and no payment will be made therefore as payment is included in payment for labor.

e. Rental time will not be allowed while equipment is inoperative due to breakdowns.

f. For equipment on Site, rental time to be paid for equipment shall be time equipment is in operation on extra Work being performed or on standby as approved by the District. The following shall be used in computing rental time of equipment:

i) When hourly rates are listed, less than 30 minutes of operation shall be considered to be 1/2 hour of operation.

ii) When daily rates are listed, less than four hours of operation shall be considered to be 1/2 Day of operation.

g. For equipment that must be brought to Site to be used exclusively on extra Work, cost of transporting equipment to Site and its return to its original location shall be determined as follows:

i) District will pay for costs of loading and unloading equipment.

ii) Cost of transporting equipment in low bed trailers shall not exceed hourly rates charged by established haulers.

iii) Cost of transporting equipment shall not exceed applicable minimum established rates of California Public Utilities Commission.

iv) District will not make any payment for transporting and loading and unloading equipment if equipment is used on Work in any other way than upon extra Work.

h. Rental period may begin at time equipment is unloaded at Site of extra Work and terminate at end of the performance of the extra Work or Day on which the District directs the Contractor to discontinue use of equipment, whichever first occurs. Excluding Saturdays, Sundays, and the District’s legal holidays, unless equipment is used to perform extra Work on such Days, rental time to be paid per Day shall be four hours for zero hours of operation, six hours for four hours of operation and eight hours for eight hours of operation, time being prorated between these parameters. Hours to be paid for equipment that is operated less than eight hours due to breakdowns, shall not exceed eight less number of hours equipment is inoperative due to breakdowns.

4. Work Performed by Special Forces or Other Special Services: When the District, the Architect and the Contractor by agreement, determine that special service or item of extra Work cannot be performed by forces of the Contractor or those of any Subcontractors, service or extra Work item may be performed by specialists. Invoices for service or item of extra Work on basis of current market price thereof may be accepted without complete itemization of labor, material, and equipment rental costs when it is impracticable and not in accordance with established practice of the special service industry to provide complete itemization. In those instances wherein the Contractor is required to perform extra Work necessitating a fabrication or machining process in a fabrication or machine shop facility away from Site, charges for that portion of extra Work performed in such facility may, by agreement, be accepted as a specialist billing. The District must be notified in advance of all off-Site Work. In lieu of overhead and profit
provided in this Section, 15 percent will be added to specialist invoice price, after
deduction of any cash or trade discount offered or available, whether or not such discount
may have been taken.

L. FORCE-ACCOUNT WORK

1. If it is impracticable because of nature of Work, or for any other reason, to fix an increase
or decrease in price definitely in advance, the Contractor may be directed to
proceed at a not-to-exceed (NTE) maximum price which shall not under any
circumstances be exceeded. Subject to such limitation, such extra Work shall be paid for
at actual necessary cost for Force-Account Work or at the negotiated cost, as determined
by the District. The cost for Force-Account Work shall be determined pursuant to this
Specification Section.

2. Force-Account Work shall be used when it is not either possible or practical to price the
changed Work prior to the start of that Work. In these cases, Force-Account Work will be
utilized during the pricing and negotiation phase of the change. Once negotiations have
been concluded and a bilateral agreement has been reached, the tracking of the Work
under Force-Account is no longer necessary. Force-Account Work shall also be used when
negotiations between the District and the Contractor have broken apart and a bilateral
agreement on the value of the changed Work cannot be reached. The District may
approve other uses of Force-Account Work.

3. Whenever any Force-Account Work is in progress, definite price for which has not been
agreed on in advance, the Contractor shall report to the District each Business Day in
writing in detail amount and cost of labor, equipment, and material used, and any other
expense incurred in Force-Account Work on the preceding day, by using a preapproved
cost proposal form. No claim for compensation for Force-Account Work will be allowed
unless report shall have been made and acknowledged by the District.

4. Whenever Force-Account Work is in progress, definite price for which has not been
agreed on in advance, the Contractor shall report to the District when 75 percent of the
NTE amount has been expended.

5. RECORDS AND CERTIFICATION

a. Force-Account (cost reimbursement) charges shall be recorded daily and
summarized in preapproved cost proposal form. The Contractor or authorized
representative shall complete and sign form each Day and submit to the District
Representative for review and approval. The Contractor shall also provide with the
form: the names and classifications of workers and hours worked by each; an
itemization of all materials used; a list by size type and identification number of
equipment and hours operated; and an indication of all Work performed by
specialists.

b. No payment for Force-Account Work shall be made until the Contractor submits
original invoices substantiating materials and equipment charges.

c. District shall have the right to audit all records in possession of the Contractor
relating to activities covered by the Contractor’s claims for modification of Contract,
including Force-Account Work and CCD Work.

d. Further, the District will have right to audit, inspect, or copy all records maintained
in connection with this Contract, including financial records, in possession of the
Contractor relating to any transaction or activity occurring or arising out of, or by virtue of, the Contract. If the Contractor is a joint venture, right of the District shall apply collaterally to same extent to records of joint venture sponsor, and of each individual joint venture member. This right shall be specifically enforceable, and any failure of the Contractor to voluntarily comply shall be deemed an irrevocable waiver and release of all claims then pending that were or could have been subject to the General Condition of Contract.

6. Force-Account Work shall be paid as extra Work under this Section. Methods of determining payment for Work and materials provided in this paragraph shall not apply to performance of Work or furnishings of material that, in judgment of the District, may properly be classified under items for which prices are otherwise established in Contract Documents.

a. Basis for Establishing Costs.
   i) Labor will be the actual cost for wages prevailing locally for each craft or type of workers at the time the extra Work is done, plus employer payments of payroll taxes and insurance, health and welfare, pension, vacation, apprenticeship funds, and other direct costs resulting from Federal, State, or local laws, as well as assessments or benefits required by lawful collective bargaining agreements. The use of a labor classification which would increase the extra Work cost will not be permitted unless the Contractor establishes the necessity for such additional costs. Labor costs for equipment operators and helpers shall be reported only when such costs are not included in the invoice for equipment rental.
   ii) Materials shall be at invoice or lowest current price at which such materials are locally available and delivered to the Site in the quantities involved, plus sales tax, freight, and delivery. The District reserves the right to approve materials and sources of supply or to supply materials to the Contractor if necessary for the progress of the Work. No markup shall be applied to any material provided by the District.
   iii) Tool and Equipment Rental. No payment will be made for the use of tools which have a replacement value of $250 or less.

b. Other Items. The District may authorize other items which may be required on the extra work. Such items include labor, services, material, and equipment which are different in their nature from those required by the Work, and which are of a type not ordinarily available from the Contractor or any of the Subcontractors. Invoices covering all such items in detail shall be submitted with the request for payment.

c. Invoices. Vendors’ invoices for material, equipment rental, and other expenditures shall be submitted with the PCO. If the request for payment is not substantiated by invoices or other documentation, the District may establish the cost of the item involved at the lowest price which was current at the time of the Daily Report.

d. Overhead and Profit. Overhead and profit is defined and shall be applied as in this Specification Section.

M. DISTRICT-FURNISHED MATERIALS

1. District reserves right to furnish materials, as it deems advisable, and the Contractor shall have no claims for costs and overhead and profit on such materials.
N. OVERHEAD DEFINED

1. The following includes, but is not limited to, costs that are deemed included in overhead for all Contract Modifications, including COs, Force-Account Work or CCD Work, whether incurred by the Contractor, Subcontractors, or suppliers, and the Contractor shall not invoice or receive payment for these costs separately:
   a. Drawings: field drawings, Shop Drawings, etc., including submissions of drawings.
   b. Routine field inspection of Work proposed.
   c. General Superintendence, including Site Superintendent, Project Engineers, Project Management or Construction Management services provided by the Contractor.
   d. General administration and preparation of cost proposals, schedule analysis, change orders and other supporting documentation as necessary.
   e. Computer services.
   f. Reproduction services.
   g. Salaries of, superintendent, foremen, timekeeper, storekeeper and secretaries
   h. Janitorial services
   i. Temporary on Site facilities, including for any extended periods of Contract Time:
      i) Offices
      ii) Telephones
      iii) Plumbing
      iv) Electrical: Power, lighting, etc.
      v) Platforms
      vi) Fencing, barricades, signage, etc.
      vii) Water

2. Home office expenses

3. Procurement and use of vehicles and fuel used coincidentally in Work otherwise included in the Contract Documents

4. Surveying

5. Estimating

6. Protection of Work

7. Handling and disposal fees

8. Final cleanup

9. Small tools

10. Warranty

11. All Contract General Conditions

12. Other incidental Work
O. Deductive Change Orders: All deductive Change Order(s) shall be prepared in the same manner as additive change orders using the same forms and formulas, with negative numbers. Overhead and profit will be neither added nor deducted when calculating deductive changes.

P. Discounts, Rebates, and Refunds: For purposes of determining the cost, if any, of any change, addition, or omission to the Work hereunder, all trade discounts, rebates, refunds, and all returns from the sale of surplus materials and equipment shall accrue and be credited to the Contractor, and the Contractor shall make provisions so that such discounts, rebates, refunds, and returns may be secured, and the amount thereof shall be allowed as a reduction of the Contractor’s cost in determining the actual cost of construction for purposes of any change, addition, or omissions in the Work as provided herein.

Q. Accounting Records: With respect to portions of the Work performed by COs and Construction Change Directives on a time-and-materials, unit-cost, or similar basis, the Contractor shall keep and maintain cost-accounting records satisfactory to the District, which shall be available to the District on the same terms as any other books and records the Contractor is required to maintain under the Contract Documents.

R. Notice Required: If the Contractor desires to make a claim for an increase in the Contract Price, or any extension in the Contract Time for completion, it shall notify the District pursuant to the General Conditions of these Contract Documents. Contractor shall proceed to execute the Work even though the adjustment may not have been agreed upon. Any change in the Contract Price or extension of the Contract Time resulting from such claim shall be authorized by a CO.

S. Applicability to Subcontractors: Any requirements under this Section shall be equally applicable to COs or Construction Change Directives issued to Subcontractors by the Contractor to the same extent required by the Contractor.

T. Alteration to Change Order Language: Contractor shall not alter or reserve time in Change Orders or Construction Change Directives. Contractor shall execute finalized Change Orders and proceed with the Work. If Contractor intends to reserve time, without an approved CPM schedule prepared pursuant to the Construction Scheduling Specification, the Contractor may be prosecuted pursuant to the False Claim Act.

1.9 CONSTRUCTION CHANGE DIRECTIVE

A. Definition: A Construction Change Directive is a written order prepared by the Architect and signed by the District and the Architect, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. The District may, by Construction Change Directive and without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions within. If applicable, the Contract Sum and Contract Time will be adjusted accordingly. In the case of a Construction Change Directive being issued, Contractor must commence Work immediately or delays from failure to perform Construction Change Directive shall be the responsibility of Contractor. Any dispute as to the sum of Construction Change Directive or timing of payment, shall be resolved pursuant to the Disputes paragraphs of these Contract Documents. A Construction Change Directive shall be used in the absence of agreement on the terms of a CO.

B. Construction Change Directives: If at any time the Architect or the District believes in good faith that a timely Change Order will not be agreed upon using the foregoing procedures, the Architect or the District may issue a CCD with a recommended cost and/or time adjustment.
1. Upon receipt of CCD, the Contractor shall promptly proceed with the change of Work involved and concurrently respond to the District’s CCD within 10 Calendar Days.

   a. Contractor’s response must be any one of following:
      i) Return CCD signed, thereby accepting the District’s response, time, and cost.
      ii) Submit a (revised if applicable) proposal with supporting documentation (if applicable, reference original proposal number followed by letter R1, R2, etc. for each revision.
      iii) Give notice of intent to submit a Claim as described in the General Conditions, and submit its Claim with 30 Calendar Days.

   b. If the CCD provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:
      i) Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation.
      ii) Unit prices stated in the Contract Documents or subsequently agreed upon.
      iii) Force account.
      iv) Cost to be determined in a manner agreed.

C. A CCD signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a PCO.

D. If the Contractor does not respond promptly, or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the District on the basis of published estimating guides, District or Architect estimating consultant analysis, or reasonable and historical expenditures and savings of those performing similar Work including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. If the parties still do not agree on the price for a CCD, the Contractor may file a Claim per General Conditions. The Contractor shall keep and present, in such form as the District may prescribe, an itemized accounting together with appropriate supporting data.

E. The amount of credit to be allowed by the Contractor for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect and the District. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

1.10 Responses: For all responses for which the Contract Documents, including without limitation this Section, do not provide a specific time period, recipients shall respond within a reasonable time.

1.11 Disputes: For all disputes arising from the procedures herein, the Contractor shall follow this Section and the Contract General Conditions.

PART 2 – PRODUCTS
Not used.

PART 3 – EXECUTION
Not used.
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in
      this document, and provisions in the General Conditions and other Division 1 Specification
      Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
   A. Section 01010 – “Summary of Work”
   B. Section 01250 – “Contract Modification Procedures”
   C. Section 01300 – “Labor Compliance Program”
   D. Section 01312 – “Project Meetings”
   E. Section 01330 – “Submittal Procedures”
   F. Section 01770 – “Contract Closeout Procedures”
   G. Section 01780 – “Project Record Documents”
   H. Divisions 2 through 33 Sections for Payment Procedures requirements for the work in those
      sections.

1.3 SUMMARY
   A. This Section includes descriptions of requirements and procedures for determining the quantity
      of Work performed during each pay period in project and the procedures for obtaining
      payment for Work performed.

1.4 CONTRACT SUM
   A. The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total
      amount payable by the District to the Contractor for performance of the Work under the
      Contract Documents.

1.5 SCHEDULE OF VALUES
   A. Within ten (10) calendar days of the award of the Contract, provide an Initial Schedule of
      Values (SOV) along with the Initial CPM Schedule per Section 01310. This initial SOV shall
      include detailed breakdown of the elements of work expected in the first 90 calendar days of
      the Contract.
   B. Submit the Master Schedule of Values for all activities and costs under the Contract.
      Coordinate activities with, and submit this Master SOV at the same time as the master CPM
      Schedule required by Section 01310.
C. The SOV shall include Contractor’s overhead, profit, insurance, cost of bonds (except to the extent expressly identified in a Proposal Item) and/or other financing, as well as general conditions costs, (e.g., Site cleanup and maintenance, temporary roads, access, signage off-Site access roads, temporary power and lighting, security, and the like). These costs shall be prorated through all activities and all Phases of the Project so that the sum of all Schedule of Values line items equals the total Contract Sum.

D. District, Architect, and Project Manager shall review the breakdown in conjunction with the Master Construction Schedule to ensure that the amounts listed in the Schedule of Values are, in fact, fair market cost allocations for the Work items listed. Upon favorable review by the District, District will accept this Schedule of Values for use. District shall be the sole judge of fair market cost allocations.

E. District will reject any attempt to increase the cost of early activities, i.e., “front loading,” resulting in a complete reallocation of moneys until such “front loading” is corrected. Repeated attempts at “front loading” may result in suspension or termination of the Work for default, or refusal to process progress payments until such time as the Schedule of Values is acceptable to District.

F. The Schedule of Values shall list line item costs for Project Closeout, Operations and Maintenance Manuals, Warranties, final test reports, and like items as required by this and other sections of the Contract Documents.

G. Format and Content: Use the Project Manual Table of Contents as a guide to establish line items for the Schedule of Values.

1. Identification: Include the following Project Identification on the Schedule of Values:
   a. Project name and Campus;
   b. Name of Architect;
   c. District’s project number;
   d. Contractor’s name and address;
   e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Specification Section or Division;
   b. Description of the Work;
   c. Name of subcontractor;
   d. Name of manufacturer or fabricator;
   e. Name of supplier;
   f. Change Orders (numbers) that affect value;
   g. Dollar value:
      i) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project
Manual Table of Contents, individual Specification Sections, and the Construction Schedule. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts. A line item for Bonds must be supported by the evidence of the Bond cost at the time of application for payment. Provide individual line items for operation and maintenance manuals, punch list activities, Project Record Documents, Title 24 closeout, LEED commissioning (if applicable), and demonstration and training (if applicable). If the values for administrative close-out items are not realistic and supportable, the Schedule of Values will not be accepted.

3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

4. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.

5. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

6. Provide separate line item in the Schedule of Values for maintenance and updating of Project Record Documents as specified in Section 01780 (Project Record Documents).

7. Provide a separate line item for DSA verified report retention if this is a DSA approved project. See General Conditions.

8. Allowances: Provide a separate line item in the Schedule of Values for each allowance.

9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

10. Schedule Updating: When Change Orders result in a change in the Contract Sum, include each Change Order as a new line item, with additional line items for detail if the change involves multiple subcontractors or significant Work in more than one Specification Section.

1.6 SUBCONTRACTOR LISTING
   A. Within five (5) days of the award of the Contract, provide the name, address, telephone number, fax number, California State Contractors Board License number, and classification of all Subcontracts for parties furnishing labor, material, or equipment for the Project.

1.7 DISTRICT APPROVAL
   A. The District shall review all submittals required above in a timely manner. All submittals must be approved by the District before becoming the supporting basis for any Contractor payment request.

1.8 PROGRESS PAYMENTS
   A. Within thirty (30) days after approval of the Request for Payment, Contractor shall be paid a sum equal to ninety percent (95%) of the value of the Work performed (as certified by Architect and Inspector and verified by Contractor) up to the last day of the previous month,
less the aggregate of previous payments. The value of the Work completed shall be Contractor’s best estimate. No inaccuracy or error in said estimate shall operate to release the Contractor, or any surety upon any bond, from damages arising from such Work, or from the District’s enforcement of each and every provision of this Contract, and the District shall have the right subsequently to correct any error made in any estimate for payment.

B. The Contractor shall not be entitled to have any payment requests processed, or be entitled to have any payment made for work performed, so long as any lawful or proper direction given by the District concerning the Work, or any portion thereof, remains incomplete.

C. Notwithstanding anything to the contrary stated above, the Contractor may include in its Request for Payment the value of any structural steel, G.F.R.C. panels and other such custom-made materials prepared specifically for the Project and unique to the Project so long as all of the following requirements are satisfied:

1. No payment shall be made for materials stored off-site without the written approval of the District to be given or withheld in the District’s sole discretion;

2. Title to such materials shall be vested in the District as evidenced by documentation satisfactory in form and substance to the District, including, but not limited to, recorded financing statements, UCC filings and UCC searches;

3. With each Contractor Request for Payment, the Contractor shall submit to the District a written list identifying each location where materials are stored off-site (which must be a bonded warehouse) and the value of the materials at each location. The Contractor shall procure insurance satisfactory to the District (in its reasonable discretion) for materials stored off-site in an amount not less than the total value thereof;

4. The consent of any Surety shall be obtained to the extent required prior to payment for any materials stored off-site;

5. Representatives of the District shall have the right to make inspections of the storage areas at any time; and

6. Such materials shall be (1) protected from diversion, destruction, theft and damage to the reasonable satisfaction of the District; (2) specifically marked for use on the Project; and (3) segregated from other materials at the storage facility.

D. The Contractor is required to order, obtain, and store materials and equipment sufficiently in advance of its Work at no additional cost or advance payment from District to assure that there will be no delays.

E. No payment by District hereunder shall be interpreted so as to imply that District has inspected, approved, or accepted any part of the Work. Notwithstanding any payment, the District may enforce each and every provision of this Contract. The District may correct any error subsequent to any payment.

1.9 APPLICATIONS FOR PROGRESS PAYMENTS

A. The Architect shall, within seven (7) days after receipt of the Contractor’s Application for Payment, either approve such payment or notify the Contractor in writing of the Architect’s reasons for withholding approval in whole or in part as provided herein. The review of the Contractor’s Application for Payment by the Architect is based on the Architect’s observations at the Site and the data comprising the Application for Payment that the Work has progressed.
to the point indicated and that, to the best of the Architect’s knowledge, information, and belief, the quality of the Work is in accordance with the Contract Documents.

B. The foregoing representations are subject to:
1. An evaluation of the Work for conformance with the Contract Documents;
2. Results of subsequent tests and inspections;
3. Minor deviations from the Contract Documents correctable prior to completion, and
4. Specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified.

C. Progress Payment Procedures include the following:
1. Pre-application Meeting. On or before the 5th Day of each calendar month during the progress of the Work, Contractor shall attend a pre-Application meeting with District’s Representatives, including the Architect, Project Manager and Project Inspector. Contractor shall provide a complete draft of the proposed Application for Payment for review. The Contractor shall revise and resubmit the draft Application for Payment, if required by District.

2. Application for Progress Payment. On or before the tenth (10th) day of each calendar month during the progress of the Work, Contractor shall submit to the Architect an itemized Application for Progress Payment for operations completed in accordance with the Schedule of Values. Such application shall be notarized, if required, and supported by the following and as required by the specifications.

3. The Contractor shall submit Applications for Payment in a form pre-approved by the District, either on or following the format of AIA G702/G703. Information shall include:
   a. The amount paid to the date of the Application to the Contractor, to all its Subcontractors, and all others furnishing labor, material, or equipment for its Contract;
   b. The amount being requested under the Application for Payment by the Contractor on its own behalf and separately stating the amount requested on behalf of each of the Subcontractors and all others furnishing labor, material, and equipment under the Contract;
   c. The balance that will be due to each of such entities after said payment is made;
   d. A certification that the Record Drawings and Annotated Specifications are current;
   e. Itemized breakdown of work done for the purpose of requesting partial payment;
   f. Where the Work is separated into Phases, provide Applications for Payment showing values correlated with each Phase separately.
   g. An updated Construction Schedule in conformance with the requirements of Section 01310, Construction scheduling.
   h. All additions to and subtractions from the Contract Price and Contract Time;
   i. A summary of the retentions held;
   j. Material invoices, evidence of equipment purchases, rentals, and other support and details of cost as the District may require;
k. An updated Schedule of values showing percentage of completion of the Contractor’s Work by line item.

D. Prerequisites for Progress Payments include the following:
   1. The following items must be submitted and approved before the first payment request will be accepted for processing:
      a. List of all subcontractors;
      b. List of Contractor’s staff assignments;
      c. Installation of the Project signs and other required temporary facilities and controls, including field office(s) required by Section 01500;
      d. Complete Schedule of Values;
      e. Initial Construction Schedule, due within [5 edit] days after Notice to Proceed;
      f. Submittal Schedule;
      g. Copies of any required permits;
      h. Copies of authorizations and licenses from governing authorities, if required;
      i. Surveyor qualifications if needed;
      j. All bonds and insurance endorsements;
      k. Other early submittals required by the Contract Documents.

E. No payment requests will be processed unless Contractor has:
   1. Submitted copies of the Certified Payroll records for the Payment Request Work period.
   2. Provided an updated Construction Schedule.
   3. Provided an updated Schedule of Values.
   4. Provided all other payment request related items required by the Contract Documents.

F. Payment requests that are not in compliance with the Contract Documents will be returned with no action taken.

G. If Contractor is late submitting an Application for Payment, that Application may be processed at any time during the one-month period, but may result in processing of the Contractor’s Application for Payment being delayed for more than a day-for-day basis. The District and its representative shall not be responsible for any such Payment being delayed due to late, incomplete, or inaccurate submission by the Contractor.

H. Any payments made to Contractor where criteria set forth in the Contract Documents have not been met shall not constitute a waiver of said criteria by District. Instead, such payment shall be construed as a good faith effort by District to resolve differences so Contractor may pay its Subcontractors and suppliers and that Contractor agrees that failure to submit such items may constitute a breach of contract by Contractor and may subject Contractor to termination or other penalty.

1.10 WARRANTY OF TITLE

A. The Contractor warrants title to all work. The Contractor further warrants that all work is free and clear of liens, claims, security interests, or encumbrances in favor of the Contractor,
Subcontractors, material and equipment suppliers, or other persons or entities making a claim by reason of having provided labor, materials, and equipment relating to the Work.

B. Failure to keep work free of liens, claims, security interests or encumbrances is grounds to make a claim against Contractor’s payment and performance bond to immediately remedy and defend.

C. If a lien or stop notice of any nature should at any time be filed against the Work or any District property by any entity which has supplied material or services at the request of the Contractor, Contractor and Contractor’s surety shall promptly, on demand by District and at Contractor’s and surety’s own expense, take any and all action necessary to cause any such lien or stop notice to be released or discharged immediately therefrom.

D. If the Contractor fails to furnish to the District within ten (10) calendar days after demand by the District, satisfactory evidence that a lien or stop notice has been so released, discharged, or secured, then District may discharge such indebtedness and deduct the amount required therefor, together with any and all losses, costs, damages, and attorney’s fees and expense incurred or suffered by District from any sum payable to Contractor under the Contract.

1.11 DECISIONS TO WITHHOLD PAYMENT

A. The District may withhold payment, in whole, or in part, to such extent as may be necessary to protect the District from loss because of, but not limited to:
   1. Defective Work not remedied;
   2. Stop Notices served upon the District;
   3. Liquidated damages assessed against the Contractor;
   4. The cost of completion of the Contract if there exists reasonable doubt that the Work can be completed for the unpaid balance of any Contract Price or by the completion date;
   5. Damage to the District or other contractor;
   6. Unsatisfactory prosecution of the Work by the Contractor;
   7. Failure to store and properly secure materials;
   8. Failure of the Contractor to submit on a timely basis, proper and sufficient documentation required by the Contract Documents, including, without limitation, acceptable monthly progress schedules, shop drawings, submittal schedules, schedule of values, product data and samples, proposed product lists, executed Change Order, Construction Change Directives, and verified reports;
   9. Failure of the Contractor to maintain record drawings;
   10. Erroneous estimates by the Contractor of the value of the Work performed, or other false statements in an Application for Payment;
   11. Unauthorized deviations from the Contract Documents;
   12. Failure of the Contractor to prosecute the Work in a timely manner in compliance with established progress schedules and completion dates.
   13. Failure to properly pay prevailing wages as defined in Labor Code section 1720, et seq.;
   14. Failure to properly maintain or clean up the Site;
   15. Payments to indemnify, defend, or hold harmless the District;
16. Any payments due to the District including but not limited to payments for failed tests, or utilities changes or permits;

17. Failure to submit an acceptable schedule in accordance with Section 01310;

18. Failure to pay Subcontractor or suppliers as required herein;

19. Failure to provide release from material suppliers or subcontractors when requested to do so.

1.12 RE-ALLOCATION OF WITHHELD AMOUNTS

A. District may, in its discretion, apply any withheld amount to payment of outstanding claims or obligations as defined in herein. In so doing, District shall make such payments on behalf of Contractor.

B. If any payment is so made by District, then such amount shall be considered as a payment made under Contract by District to Contractor and District shall not be liable to Contractor for such payments made in good faith. Such payments may be made without prior judicial determination of claim or obligation. District will render Contractor an accounting of such funds disbursed on behalf of Contractor.

C. If Contractor defaults or neglects to carry out the Work in accordance with the contract documents or fails to perform any provision thereof, District may, after ten (10) calendar days written notice to the Contractor and without prejudice to any other remedy make good such deficiencies.

D. The District shall adjust the total Contract price by reducing the amount thereof by the cost of making good such deficiencies. If District deems it inexpedient to correct Work which is damaged, defective, or not done in accordance with Contract provisions, an equitable reduction in the Contract price (of at least 150% of the estimated reasonable value of the nonconforming work) shall be made therefore.

1.13 PAYMENT AFTER CURE

A. When the grounds for declining approval are removed, payment shall be made for amounts withheld because of them. No interest shall be paid on any retainage or amounts withheld due to the failure of the Contractor to perform in accordance with the terms and conditions of the Contract Documents.

1.14 NONCONFORMING WORK

A. Contractor shall promptly remove from premises all Work identified by District as failing to conform to the Contract whether incorporated or not. Contractor shall promptly replace and re-execute its own Work to comply with the Contract without additional expense to District and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

B. If Contractor does not remove such Work which has been identified by District as failing to conform to the Contract Documents within a reasonable time, fixed by written notice, District may remove it and may store the material at Contractor’s expense. If Contractor does not pay expenses of such removal within ten (10) calendar days’ time thereafter, District may, upon ten (10) calendar days’ written notice, sell such materials at auction or at private sale and shall
account for net proceeds thereof, after deducting all costs and expenses that should have been borne by Contractor.

1.15 **SUBCONTRACTOR PAYMENTS**
   A. No later than ten (10) days after receipt, or pursuant to Business and Professions Code Section 7108.5 and Public Contract Code section 7107, the Contractor shall pay to each Subcontractor, out of the amount paid to the Contractor on account of such Subcontractor’s portion of the Work, the amount to which said Subcontractor is entitled. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

1.16 **NO OBLIGATION OF DISTRICT FOR SUBCONTRACTOR PAYMENT**
   A. The District shall have no obligation to pay, or to see to the payment of, money to a Subcontractor except as may otherwise be required by law.

1.17 **PAYMENT NOT CONSTITUTING APPROVAL OR ACCEPTANCE**
   A. An approved Request for Payment, a progress payment, or partial or entire use or occupancy of the Project by the District shall not constitute acceptance of Work not in accordance with the Contract Documents.

1.18 **JOINT CHECKS**
   A. District shall have the right, if necessary for the protection of the District, to issue joint checks made payable to the Contractor and Subcontractors and material or equipment suppliers. The joint check payees shall be responsible for the allocation and disbursement of funds included as part of any such joint payment. In no event shall any joint check payment be construed to create any contract between the District and a Subcontractor of any tier, any obligation from the District to such Subcontractor, or rights in such Subcontractor against the District.

1.19 **NO WAIVER**
   A. Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

1.20 **FINAL PAYMENT**
   A. Contractor shall comply with requirements of Section 01770 Contract Closeout Procedures.
   B. Contractor shall maintain the presence of Project Superintendent and Project Manager until the Work is complete.
   C. Under no circumstances shall Contractor demobilize its forces prior to completion of the Final Punchlist. Upon receipt of Contractor’s written notice that all of the Final Punchlist items have been fully completed and the Work is ready for final inspection and acceptance, Architect shall inspect the Work and shall submit to Contractor and District a final inspection report noting which work, if any, is required to be completed in accordance with the Contract Documents. Absent unusual circumstances, this report shall consist of the Punchlist items not yet satisfactorily completed.
D. Upon completion of the Work contained in the Final Inspection report, the Contractor shall notify the District and Architect, who shall again inspect such Work. If the Architect and the District finds the Work contained in such Final Inspection report acceptable under the Contract Documents and, therefore, the Work fully completed, it shall notify Contractor, who may then submit to the Architect its final Application for Payment.

E. Upon receipt and approval of such final Application for Payment, the Architect shall issue a final Certificate of Payment stating that to the best of its knowledge, information, and belief, and on the basis of its observations, inspections, and all other data accumulated or received by the Architect in connection with the Work, such Work has been completed in accordance with the Contract Documents. The District shall thereupon inspect such Work and either accept the Work as complete or notify the Architect and the Contractor in writing of reasons why the Work is not complete. Upon acceptance of the Work of the Contractor as fully complete (which, absent unusual circumstances, will occur when the Punch List items have been satisfactorily completed), the District shall record a Notice of Completion with the County Recorder, and the Contractor shall, upon receipt of payment from the District, pay the amounts due Subcontractors.

F. The following conditions must be fulfilled prior to Final Payment:
   1. A full and final waiver or release of all Stop Notices in connection with the Work shall be submitted by Contractor, including a release of Stop Notice in recordable form, together with (to the extent permitted by law) a copy of the full and final release of all Stop Notice rights.
   2. The Contractor shall have made all corrections to the Work required to remedy any defects therein, to obtain compliance with the Contract Documents or any requirements of applicable codes and ordinances, or to fulfill any of the orders or directions of District.
   3. Each Subcontractor shall have delivered to the Contractor all written guarantees, warranties, applications, and bonds required by the Contract Documents for its portion of the Work.
   4. Contractor must have completed all requirements set forth in Section 01770 Contract Closeout Procedures.
   5. Architect shall have reviewed and approved a Final Application for Payment.
   6. The Contractor shall have completed final clean up as required by Section 01710 Cleaning Requirements.

1.21 RETAINAGE

A. The retainage, less any amounts disputed by the District or which the District has the right to withhold, shall be paid:
   1. After approval by District and Architect of the Contractor’s final Application for Payment;
   2. After satisfaction of all terms and conditions set forth in the Contract Documents, and
   3. After thirty-five (35) days after the acceptance of the Work by the District Governing Board and recording of the Notice of Completion by District.

B. No interest shall be paid on any retainage, or on any amounts withheld due to a failure of the Contractor to perform in accordance with the terms and conditions of the Contract Documents,
except as provided to the contrary in any Escrow Agreement between the District and the Contractor pursuant to Public Contract Code § 22300.

1.22 SUBSTITUTION OF SECURITIES
   A. The District will permit the substitution of securities in accordance with the provisions of Public Contract Code section 22300.

1.23 ALLOWANCES
   A. District will authorize and direct Contractor regarding provisions in this paragraph.
   B. Allowance Amount: as listed in Section 01210 (Allowances).
   C. District shall determine in its sole discretion which costs, if any, it will authorize in writing to be paid from the Allowance. Generally, the Allowance will be used only for District-initiated changes in the Scope of Work.
   D. Costs for Allowance Work shall be determined as provided in Section 01250, Contract Modification Procedures.

PART 2 – PRODUCTS
Not Used.

PART 3 – EXECUTION
Not Used.

END OF SECTION 01290
SECTION 01300  
LABOR COMPLIANCE PROGRAM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 0 and Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01290 – “Payment Procedures”
B. Section 01770 – “Contract Closeout Procedures”
C. Divisions 2 through 33 Sections for Labor Compliance Program requirements for the work in those Sections.

1.3 SUMMARY
A. The District implements a Labor Compliance Program in an effort to fulfill the need and intent of monitoring, documenting and reporting the wage rates and payments to workers employed on or at a public works construction project.
B. Contractors and subcontractors performing work on District projects will be expected to adhere to the labor compliance provisions outlined in Division 2, Part 7, Chapter 1 of the California Labor Code §1720- 1861 including, but not limited to, the reporting of certified payroll, payment of prevailing wages and the employment of apprentices.

1.4 LABOR COMPLIANCE PROGRAM REQUIREMENTS
A. California Labor Code Section 1770, et seq., and Education Code Section 17424 require that contractors on Public works projects pay their workers based on the prevailing wage rates which are established and issued by the Department of Industrial Relations, Division of Labor Statistics and Research.
   1. Pursuant to the provisions of Division 2, Part 7, Chapter 1, Article 2 of the California Labor Code §1770, et seq., the District has obtained from the Director of the California Department of Industrial Relations the general prevailing rate of per diem wages and the prevailing rate for straight time, holiday time and overtime work in the locality in which the work is to be performed for each craft, classification or type of worker needed to execute the contract. The prevailing wage determination can be accessed online at http://www.dir.ca.gov/dlsr/DPreWageDetermination.htm. Copies of the prevailing rate of per diem wages are also on file at the District office, which shall be made available to
any interested party on request. Per diem wages shall be deemed to include employer payments for health and welfare, pensions, vacation, travel time and subsistence pay as provided in California Labor Code §1773.1 and as shown in the Director’s determination. For apprenticeship or other training programs authorized by California Labor Code §3093, and similar purposes, when the term “per diem wages” is used herein it shall have the meaning as defined in the prevailing wage determination as published by the Director of the California Department of Industrial Relations and California Labor Code.

2. The contractor shall post at an appropriate conspicuous weatherproof point on the site of the project a copy of the prevailing wage determination published by the Director of the California Department of Industrial Relations which is applicable to the project and the Notice of Approval of the Labor Compliance Program.

3. There shall be paid to each worker of the contractor or any subcontractor, of any tier, engaged in the work, not less than the general prevailing wage rate regardless of any contractual relationship which may be alleged to exist between the contractor or any subcontractor, of any tier, and such worker. The contractor and subcontractors will be required to pay all workers on a weekly basis. Each worker needed to execute the work on the project shall also be paid travel and subsistence payments, as such travel and subsistence payments are defined in the prevailing wage determination published by the Director of the California Department of Industrial Relations.

4. Holiday and overtime work, when permitted by law, shall be paid for at the rate identified in the prevailing wage determination issued by the Director of the California Department of Industrial Relations. In accordance with Labor Code §1815, work performed by employees of contractors in excess of 8 hours per day, and 40 hours during any one week, shall be permitted upon public work upon compensation for all hours worked in excess of 8 hours per day at not less than 1 1/2 times the basic rate of pay.

5. The Contractor shall forfeit fifty dollars ($50.00) for each calendar day or portion thereof, for each worker paid less than the prevailing rates as determined by the Director of the California Department of Industrial Relations for such work or craft in which such worker is employed by the contractor or by any subcontractor, of any tier, in connection with the work. Pursuant to California Labor Code §1775, the difference between such prevailing wage rates and the amount paid to each worker for each calendar day, or portion thereof, for which each worker was paid less than the prevailing wage rate, shall be paid to each worker in the addition to the penalties. The amount of forfeiture shall be determined by the Labor Commissioner and shall be based on consideration of the contractor’s mistake, inadvertence, or neglect in failing to pay the correct rate of prevailing wages. The contractor’s previous record in meeting the prevailing wage obligations or the contractor’s willful failure to pay the correct rates of prevailing wages may influence the amount of penalty.

6. In accordance with Labor Code §1813, the contractor or subcontractor shall, as a penalty to the state or political subdivision on whose behalf the contract is made or awarded, forfeit twenty-five dollars ($25) for each worker employed in the execution of the contract by the respective contractor or subcontractor for each calendar day during which the worker is required or permitted to work more than 8 hours in any one calendar day and 40 hours in any one calendar week in violation of the provisions of this article. In awarding any contract for public work, the awarding body shall cause to be inserted in the contract a stipulation to this effect. The awarding body shall take

Contra Costa Community College District          Section 01300 - Page 2 of 5
Diablo Valley College                                      Labor Compliance Program
D-4002 SRC Increment 2 – Expansion & Renovation
B. California Labor Code Section 1776 requires contractors to keep accurate payroll records of trade workers on all public works projects and to submit copies of certified payroll records upon request.

1. Pursuant to California Labor Code §1776, the contractor and every subcontractor, of any tier, shall keep accurate payroll records, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per them wages paid to each journeyman, apprentice, worker or other employee employed by them in connection with the public works project. The payroll records shall be certified and submitted bi-weekly to the Labor Compliance Representative and shall be available for inspection at all reasonable hours at the principal office of the Contractor on the following basis:

2. A certified copy of an employee’s payroll record shall be made available for inspection or furnished to such employee or his/her authorized representative on request;

3. A certified copy of all payroll records shall be made available for inspection or furnished upon request to the District, the Division of Labor Standards Enforcement and the Division of Apprenticeship Standards of the Department of Industrial Relations;

4. A certified copy of payroll records shall be made available upon request to the public for inspection or copies thereof made; provided, however, that a request by the public shall be made through the District, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. The contractor shall have ten (10) days in which to completely comply, subsequent to receipt of written notice specifying in what respects the contractor must comply herewith. Should noncompliance be evident after such 10-day period, the contractor shall, as a penalty to the District, forfeit Twenty-Five Dollars ($25.00) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated.

C. California Labor Code Section 1777.5 requires contractors to employ registered apprentices on public works projects.

1. Per California Labor Code §1777.5(e), the contractor and all subcontractors shall notify an approved training program that can supply apprentices to the area of the public works project. The contractor and subcontractors shall submit contract award information to the applicable joint apprenticeship committee which shall include an estimate of journeyman hours to be performed under the contract, the number of apprentices to be employed, and the approximate dates the apprentices will be employed. Additionally, the contractor and subcontractors shall request, from the joint apprenticeship committee, dispatch of apprentices on the public works project using the state form DAS-142.

2. All apprentices employed by the contractor to perform any of the work shall be paid the prevailing wages identified by the Director of the California Department of Industrial Relations. Only apprentices, as defined in California Labor Code §3077 who are in training under apprenticeship standards and written apprenticeship agreements under California Code §§3070, et seq., are eligible to be employed for the work. The employment and training of each apprentice shall be in accordance with the provisions of the...
apprenticeship standards and apprentice agreements under which such apprentice is training or the standards established by the Division of Apprenticeship Standards.

3. The ratio of work performed by apprentices to journeymen, who shall be employed in the work, may be the ratio stipulated in the apprenticeship standards under which the joint apprenticeship committee operates, but in no case shall the ratio be less than one hour (1) of apprentice work for each five (5) hours of labor performed by a journeyman, except as otherwise provided in California Labor Code §1777.5. Any ratio shall apply during any day or portion of a day when any journeyman, or the higher standard stipulated by the joint apprenticeship committee, is employed at the site of the Work and shall be computed on the basis of the hours worked during the day by journeymen so employed, except for the land surveyor classification. The Contractor shall employ apprentices for the number of hours computed as above before the completion of the work. The contractor shall, however, endeavor, to the greatest extent possible, to employ apprentices during the same time period that the journeymen in the same craft or trade are employed at the site of the Work. Where an hourly apprenticeship ratio is not feasible for a particular craft or trade, the Division of Apprenticeship Standards, upon application of a joint apprenticeship committee, may order a minimum ratio of not less than one apprentice for each five journeymen in a craft or trade classification. This article shall not apply to contracts of general contractors, or to contracts of specialty contractors not bidding for work through a general or prime contractor, involving less than thirty thousand dollars ($30,000).

4. The contractor or any subcontractor, of any tier, who performs any of the work by employment of journeymen or apprentices in any apprenticeable craft or trade and who is not contributing to a fund or funds to administer and conduct the apprenticeship program in any such craft or trade in the area of the site of the work, to which fund or funds other contractors in the area of the site of the work are contributing, shall contribute to the fund or funds in each craft or trade in which it employs journeymen or apprentices in the same amount or upon the same basis and in the same manner as the other contractors do, but where the trust fund administrators are unable to accept such funds, contractors not signatory to the trust agreement shall pay a like amount to the California Apprenticeship Council. The contractors shall provide proof of such contributions when requested, including checks, check stubs, receipts, or other records required to prove that all required payments were made.

5. In the event the contractor willfully fails to comply with the provisions of California Labor Code §1777.5, and pursuant to California Labor Code §1777.7, the contractor shall: (i) be denied the right to bid on any public works contract for a period of one (1) year from the date the determination of non-compliance is made by the administrator of apprenticeship; and (ii) forfeit, as a civil penalty, one hundred dollars ($100.00) and up to three hundred dollars ($300.00) for each calendar day of noncompliance. The District shall withhold such amount from the contract price then due or to become due upon request of the Division of Apprenticeship Standards.

D. This Labor Compliance Program (“LCP”) contains the labor compliance standards required by state and federal laws, regulations and directives, as well as policies and contract provisions, which include, but are not limited to, the following:

1. Contractors’ payments of applicable general prevailing wage rates.
2. Contractors’ employment of properly registered apprentices.
3. Contractors’ providing certified payroll records.
4. LCP monitoring a construction site for the verification of proper payments of prevailing wage rates and work classification.
5. LCP conducting pre-job conferences with contractors/subcontractors.
6. LCP withholding contract payments and imposing penalties for noncompliance.
7. LCP preparation and submittal of annual reports.

E. If any provisions of this Section conflict with current California Labor Code, current Labor Code shall govern Work under this contract.

F. A third party, if authorized and empowered through contract with the Contra Costa Community College District, may provide the Labor Compliance Program oversight. The Contractor shall coordinate through the District’s Representative for the program and contact information of the Labor Compliance Program.

END OF SECTION 01300
SECTION 01305
DELAY AND EXTENSIONS TO THE WORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01010 – “Summary of Work”
B. Section 01250 – “Contract Modification Procedures”
C. Section 01310 – “Construction Scheduling”
C. Section 01311 – “Project Management and Coordination”
D. Divisions 2 through 33 Sections for Delay and Extensions to the Work requirements for the work in those Sections.

1.3 SUMMARY

A. This Section includes administrative and procedural requirements for evaluation of excusable delays including delays due to abnormal or adverse weather conditions.

1.4 DELAYS AND EXTENSIONS TO THE WORK

A. Contractor must complete all Work within the time specified in these Contract Documents. The Contractor will be granted an extension of time and will not be assessed liquidated damages or the cost of engineering and inspection for any delay in substantially completing the Work (or parts thereof) beyond the time set elsewhere in the Contract Documents, provided that such delay was caused by unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include fire, floods, abnormal weather (as described below), and earthquakes, embargoes, changes made pursuant to the provisions of “Changes in work” elsewhere in the Contract Documents or acts or neglect of the District not contemplated by the Contract Documents. In all cases, any extension of time is conditioned on the following:

1. That the cause is not due to the fault or negligence of the Contractor, and the Contractor has taken reasonable precautions to prevent the delays and minimize the effects thereof; and

2. That the Contractor notifies the District, Architect, Project Manager, and project Inspector in writing within five (5) days from the beginning of such delay, specifying the nature of the delay and the measures that have been or will be taken to prevent or minimize the delay. Failure to submit written notice within this time period shall constitute an absolute waiver of any claim for a time extension.
B. No extension of time will be granted for a delay caused by a shortage of materials, unless the Contractor furnishes to the District documentary proof that he has diligently made every effort to obtain such materials from all known sources within reasonable distance of the work and further proof, in the form of schedule data as required in Section 01310 that the inability to obtain such materials as originally planned did in fact cause a delay in final completion of the Work which could not be compensated for by revising the sequence of the Contractor’s operations. Only the physical shortage of material will be considered as a cause for extension of time, and no consideration will be given to any claim that material could not be obtained at a reasonable, practical or economical cost or price, unless it is shown to satisfaction of the District that such material could have been obtained only at exorbitant prices, taking into account the quantities involved and the usual practices in obtaining such quantities.

C. The term “shortage of materials,” as used in this section, shall apply only to materials, articles, parts or equipment which are standard items and shall not apply to materials, parts, articles or equipment which are processed, made, constructed, fabricated or manufactured to meet the specific requirements of the Contract Documents.

D. No extensions of time will be granted for delay that have no measurable impact on the completion of the Work (or parts thereof) under the Contract Documents. When extensions of time are granted, they will be limited to the period equivalent to the actual number of days lost on the critical path or controlling operations of the current approved Construction Schedule, taking into account the extent to which that delay could be decreased by reasonable mitigation measures by the Contractor. All requests for extensions of time must be supported with a critical path analysis showing the critical path and impacts to it. Contractor’s failure to submit this analysis will be sufficient cause for denial of any request for a time extension.

E. Within a reasonable period of time after the Contractor submits the notice of delay along with any other information required by this section, the District will determine whether an extension of time is justified and, if so, the number of days for the extension.

1.5 ABNORMAL OR ADVERSE WEATHER CONDITIONS

A. Time extensions caused by abnormal weather will be allowed only if there is rain in excess of 0.5 inch in a 24 hours period, as measured at the Concord, CA, Airport weather station maintained by the National Weather Service, for a number of days that exceeds the number of average rain days. For the purposes of this Project, the Contractor shall include within the Contract Time of its Master CPM Schedule an allowance of 27 work days, just prior to its Substantial Completion date milestone activity, for normally anticipated adverse weather. The allowance will be reduced pursuant to the procedures noted in this Section for abnormal weather. In the event this allowance is consumed, a non-compensable time extension for abnormal weather will be granted pursuant to the procedures of this Section. If this allowance is not consumed by normal adverse weather, the remaining work days will be considered project float as defined in Section 01310, Construction Scheduling.

B. In addition, before a time extension may be granted for abnormal weather, Contractor must establish to District satisfaction that the rain either significantly impacted at least 75% of the planned work of the critical path operations for a particular day or prohibited at least five (5) hours of work on the critical path operations planned for that day.
C. In the event that the project experiences favorable weather for a particular month (e.g. a number of actual rain days less than that allocated for allowable rain days per month), the cumulative float resulting from such favorable weather shall accrue to the project.

D. Rain delay shall be only for the actual period of time established pursuant to full compliance with the above requirements.

E. Contractor shall take reasonable steps to mitigate potential weather delays, such as dewatering the Site, providing access roads that are stable under abnormal or adverse weather conditions, and covering work and material that could be affected adversely by weather. Failure to do so shall be cause for the District to not grant a time extension due to abnormal or adverse weather, where Contractor could have avoided or mitigated the potential delay by exercising reasonable care.

F. Abnormal weather may be a valid basis for a time extension under the Contract. The term “abnormal weather” is defined as the occurrence rain conditions that exceed the criteria set forth that cause impact to Contractor’s operations.

G. Contractor shall employ reasonable methods to mitigate the impact of abnormal weather (i.e. dewatering, protection of site, etc.) The occurrence of rain during non-work hours or having minimal impact to work on the controlling operation shall not constitute a day of abnormal weather.

1.6 ENTITLEMENT TO CLAIM FOR DELAY AND EXTENSIONS TO THE WORK

A. Any Contractor claim for damages or additional compensation based on delay shall be limited to only those circumstances where the Contractor has fulfilled at least one of the following three (3) requirements:

   1. Contractor has established its entitlement to a time extension pursuant to the provisions described above regarding delay and extensions to the Work.

   2. The delay was caused solely by the District by District’s issuance of changes made pursuant to the provisions of “Changes in Work” elsewhere in these General Conditions or by or acts of neglect of the district.

   3. The delay was unreasonable under the circumstances and not within the contemplation of the parties and/or the Contract Documents.

B. It is expressly understood and agreed that delays caused by the District will be non-compensable when there are concurrent delays caused by the Contractor. Also, Contractor shall have no entitlement to additional compensation for any delay where there have been concurrent delays caused by non-compensable delays, including, but not limited to, fire, floods, tidal waves, earthquakes, epidemics, quarantine restrictions, strikes, labor disputes and freight embargoes weather days.
C. In the event that the Contractor submits a claim for additional costs associated with overhead, the Contractor shall, within 60 calendar days of the District’s written request, submit to the District an audit examination and report performed by an independent Certified Public Accountant certifying the Contractor’s actual unanticipated overhead costs. The independent Certified Public Accountant’s audit examination shall be performed in conformance with the requirements of the American Institute of Certified Public Accountants Attestation Standards. The audit examination and report shall depict the Contractor’s project and company-wide financial records and shall specify the actual overall average daily rates for both field and home office overhead for the entire duration of the project, and whether the costs have been properly allocated. The rates of field and home office overhead shall exclude all unallowable costs as determined in the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31. The audit examination shall determine if the rates of field and home office overhead:

1. Are allowable in conformance with the requirements of the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31;
2. Are adequately supported by reliable documentation; and
3. Related solely to the project under examination.

D. Upon the District’s written request, the Contractor shall make its financial records available for audit by the District for the purpose of verifying the actual rate of overhead specified in the audit submitted by the Contractor. The overhead specified in the audit, submitted by the Contractor, will be subject to review and approval by the District.

PART 2 – PRODUCT
Not Used.

PART 3 – EXECUTION
Not Used.

END OF SECTION 01305
SECTION 01310
CONSTRUCTION SCHEDULING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01290 – “Payment Procedure”
C. Section 01312 – “Project Meetings”
D. Section 01330 – “Submittal Procedures”
E. Section 01610 – “Basic Product Requirements”
F. Section 01770 – “Contract Closeout Procedures”
G. Divisions 2 through 33 Sections for Construction Scheduling requirements for the work in those Sections.

1.3 SUMMARY
A. This Section describes the requirements for Project construction schedules and reports.
B. Development of schedules, cost loading of the schedule, and schedule updates, monthly payment requests, and project status reporting requirements of the Contract shall employ computerized Critical Path Method (CPM) scheduling utilizing Primavera P6.
C. All CPM schedules shall be cost loaded based on the Master Schedule of Values as approved by District and Architect.
D. **Contractor shall provide one Primavera P6 licenses to be used by the on-site District personnel for the duration of the project.**

1.4 FAILURE TO MEET SCHEDULING REQUIREMENTS
A. Failure of the Contractor to provide proper schedules as required by this Section is a material breach of the contract and grounds for termination pursuant to the General Conditions. The District, at its sole discretion, may choose, instead, to withhold, in whole or in part, any progress payments or retention amounts otherwise payable to the Contractor.
1.5 SCHEDULER's QUALIFICATIONS

A. Contractor shall utilize experienced scheduling personnel qualified to use Primavera P6 Enterprise, current version scheduling software, or alternate software if approved by the District. Experience level required is set forth below. Contractor may employ such personnel directly or may employ a consultant for this purpose.

B. Within five (5) days after bid opening, the apparent successful low bidder shall provide to District and Architect a written verification either that Contractor has the required personnel under its employ or that Contractor will employ a CPM scheduling consultant. This written verification shall include:

1. Name of the individual who will perform all required CPM scheduling tasks during the entire Project.

2. Resume of the individual, to include description of similar, recent construction projects on which the individual has successfully created and updated computerized CPM schedules. Experience must include at least two projects of similar nature, scope and value not less than three-fourths the Contract Price of this Project.

3. Contact persons for all referenced projects with current telephone and address information.

C. District reserves right to accept or reject Contractor's scheduler, and right to reject them at any time.

D. District also reserves right to refuse replacement of Contractor's scheduler if it believes such replacement will negatively affect the Project.

1.6 CONSTRUCTION SCHEDULES, GENERAL

A. Upon Notice to Proceed, Contractor shall immediately commence development of initial and Master CPM Schedules. Reference to Project Schedule shall pertain to the initial CPM schedule, Master CPM schedule or an update of the master CPM Schedule as appropriate during the time period it is in affect during construction. When reference is made in the Contract Documents to a Baseline CPM Schedule, shall have the same meaning as an update to the Master CPM Schedule.

B. All construction schedules shall be based on and incorporate all milestones and completion dates specified in the Contract Documents. See also Sections 01010, Summary of Work. Show in the schedule the sequence in which the Contractor proposes to perform the Work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of the entire project is required. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the Project shall also contribute in developing and maintaining an accurate Project Schedule. Provide a Project Schedule that is a forward planning as well as a project monitoring tool.
C. Use the approved Project Schedule to measure the progress of the Work and to aid in evaluating time extensions.

D. Make the master CPM Schedule cost loaded and activity coded.

E. The schedule will provide the basis for all progress payments. If the Contractor fails to submit any schedule within the time prescribed, the District may withhold approval of progress payments until the Contractor submits the required schedule.

F. Provide a Schedule Status Report on at least a monthly basis. If, in the opinion of the District, the Contractor falls behind the approved schedule, the Contractor shall take all steps necessary to improve its progress including those that may be required by the Architect or Project Manager, without additional cost to the District. In this circumstance, the District may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules as the District deems necessary to demonstrate how the approved rate of progress will be regained.

G. Failure of the Contractor to comply with the requirements of the District shall be grounds for a determination that the Contractor is not prosecuting the Work with sufficient diligence to ensure completion within the time specified in the Contract Documents. Upon making this determination, the District may terminate the Contractor’s right to proceed with the Work, or any separable part of it, in accordance with the default terms of the Contract.

H. Use the project CPM Schedule as the basis for determining Contract earnings during each update period and therefore the amount of each progress payment. Lack of an approved schedule update, or qualified scheduling personnel, will result in the inability of the Architect to evaluate contract earned value for the purposes of payment. Failure of the Contractor to provide all required information will result in the disapproval of the Initial, Master and subsequent updates of the Master CPM Schedule. In the event Project Schedule revisions are directed by the District and those revisions have not been included in subsequent revisions or Updates, the District may hold retainage up to the maximum allowed by Contract, each payment period, until such revisions to the Master CPM Schedule have been made.

I. No Project Schedule shall exceed time limits set forth in the Contract Documents. Failure to submit a schedule, or submittal of a Project Schedule which shows completion of the Work beyond the specified completion date shall be deemed a material breach by the Contractor.

J. All Project Schedules must indicate the beginning and completion of all Work and shall use the “Critical path Method” for the value reporting, planning and scheduling of all Work required under the Contract Documents.

K. Overall time of completion between the Notice to Proceed and Substantial Completion to Final Completion shown on any Project Schedule shall adhere to completion times as stated in the Construction Agreement, unless an earlier (advanced) time of completion is requested by Contractor and agreed to by District. Any such agreement shall be formalized by a Change Order.

1. District is not required to accept an advanced schedule, i.e., one that shows early completion dates for the Work or any Phase of the Work.

2. In the event agreement is reached between Contractor and District on an advanced schedule, Contractor shall not be entitled to extra compensation if Contractor completes
its Work, for whatever reason (excepting approved changes with added time components) beyond completion date(s) shown in any approved advanced schedule but within the originally specified completion dates.

3. Contractor shall not submit a schedule showing early completion without indicating float time through the date set for Project completion by District.

4. Contractor’s schedule shall account for all days past early completion as float which belongs to the Project. Usage of float shall not entitle Contractor to any delay claim or damages due to delay.

L. Float Ownership: Neither the District nor the Contractor owns float. The Project owns the float. As such, liability for delay of the Substantial Completion Date(s) rests with the party whose actions, last in time, actually cause delay to the Substantial Completion Date(s).

1. For example, if Party A uses some, but not all of the float and Party B later uses remainder of the float as well as additional time beyond the float, Party B shall be liable for the time that represents a delay to the Substantial Completion Date.

2. Party A would not be responsible for the time since it did not consume the entire float and additional float remained; therefore, the Substantial Completion Date was unaffected.

M. The architect may disapprove of any construction schedule or require modification to it if, in the opinion of the Architect or District, adherence to the construction schedule will not cause the Work to be completed in accordance with the Agreement.

N. Use Primavera P6, compatible with Windows operating system for creation and updates of all required construction schedules. Contractor shall provide digital schedule files to District on CD at times requested by District.

O. Transmit construction schedule files under form approved by District.

1.7 SCHEDULE FORMAT AND LEVEL OF DETAIL

A. All Work activity durations shall be in Workdays.

B. The Schedule shall be the basis for evaluating job progress, payment requests, and time extension requests associated with the changes.

C. Responsibility for developing all Schedules and monitoring actual progress rests with Contractor. Schedules shall comply with following requirements:

1. All Contractor, Subcontractor and assigned Contractor work shall be shown in a logical work sequence that demonstrates a coordinated plan of work for all contractors. The intent is to provide a common basis of acceptance, understanding and communication, as well as interface with other contractors.

2. Activities related to the delivery of Contractor and District-furnished equipment to be Contractor installed per Contract shall be shown.
   a. District-furnished District Installed materials and equipment, if any, shall be identified as separate activities.

3. Show District and other agency activities that could impact progress. These activities include, but are not limited to: approvals, submittal reviews, environmental permit
approvals by State regulators, inspections, utility tie-in, Owner Furnished Equipment (OFE) and Notice to Proceed (NTP) for Phasing requirements.

4. All activities shall be identified through codes or other identification to indicate the phase of Work and Contractor/Subcontractor responsibility to which they pertain.

5. Show the critical path in red. For each activity, show early start, late start, early finish, late finish, durations measured in days, float, predecessor and successor activities, planned workday/week for the activity, and scheduled/actual progress payments.

6. Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have durations greater than 20 work days or 30 calendar days unless otherwise approved by District and Architect. Procurement activities are defined herein.

   a. Procurement Activities
      
      i) The schedule must include activities associated with the submittal, approval, procurement, fabrication and delivery of long lead materials, equipment, fabricated assemblies and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 45 calendar days. A typical procurement sequence includes the string of activities: submit, approve, procure, fabricate, and deliver. Procurement of all contract required material and equipment shall be identified as a separate activity.
      
      ii) These activities shall not be cost loaded unless previously approved, at the District’s sole discretion, by the District.

   b. Include time for fabrication and delivery of manufactured products for the Work.

   c. Show dependencies between procurement and related construction activity.

7. Activity durations shall be total number of actual work days required to perform that activity.

8. Provide activity coding to enable sorting by responsibility, location, phase of Work, Work Restriction, and CSI division. Assign activity codes to any activity or sequence of activities added to the Project Schedule as a result of a Change Orders, when approved by the District with a Change Order code. Integrate the code values to the Contractor’s numbering system. An activity shall not have more than one Change Order code.

9. The start and completion dates of all items of Work, Work Phases, their major components, and milestone completion dates shall be included.

10. Mandatory Tasks. The following tasks must be included and properly scheduled. Items noted with “SOV item upon Approval only” shall include an amount in the cost loaded schedule and in the SOV:

   a. Submission of mechanical/electrical/information systems layout drawings.

   b. Submission, review and acceptance of DSA deferred approval packages. (SOV item upon Approval only)
c. Submission and approval of O & M manuals. (SOV item upon Approval only)
d. Submission and approval of as-built drawings. (SOV item upon Approval only)
e. Submission and approval of installed equipment lists. (SOV item upon Approval only)
f. Submission and approval of testing and air balance (TAB) if applicable. (SOV item upon Approval only)
g. Submission of TAB specialist design review report if applicable.
h. Submission and approval of fire protection specialist if applicable.
i. Submission and approval of testing and balancing of HVAC plus commissioning plans and data if applicable.
j. Air and water balancing if applicable.
k. HVAC commissioning if applicable.
l. Controls testing plan submission if applicable.
m. Controls testing if applicable.
n. Performance Verification testing if applicable. (SOV item upon Approval only)
o. Other systems testing, if required.
p. Contractor's pre-final inspection.
q. Correction of punch list from Contractor's pre-final inspection. (SOV item upon Approval only)
r. District's pre-final inspection.
s. Correction of punch list from District's pre-final inspection. (SOV item upon Approval only)
t. Final inspection.
u. Allowances for normal weather and Campus non-work days

11. Dependencies (or relationships) between activities shall be shown.
12. Complete all activity descriptions, including what Work is to be accomplished, where, and when.
13. Include anticipated non-Work days, such as weekends, holidays, and/or other observances in the Schedule.
14. Provide activity coding to enable sorting by responsibility, location, phase of Work, Work Restriction, and CSI division. Assign activity codes to any activity or sequence of activities added to the Project Schedule as a result of a Change Orders, when approved by the District with a Change Order code. Integrate the code values to the Contractor's numbering system. An activity shall not have more than one Change Order code.
15. The start and completion dates of all items of Work, Work Phases, their major components, and milestone completion dates shall be included.
16. Contractor’s Shop Drawing and Samples Submittal Schedule: As part of the Master CPM Schedule submittal, the Contractor shall prepare a separate schedule for review and approval by the Architect and the District, detailing the processing and approval of submittals and shop drawings for all Contract-required material and equipment. This
schedule shall be extracted from the Master CPM Schedule. Activities that are dependent on submittal acceptance or material delivery shall not be scheduled to start earlier than expected acceptance or delivery dates.

a. Include time for submittals, resubmittals, and reviews by District and DSA. Coordinate with accepted Project Schedule for submission of shop drawings, samples and other submittals.

b. Contractor shall be responsible for all impacts resulting from resubmittal of either shop drawings or any other required submittal.

17. Complete all activity descriptions, including what Work is to be accomplished, where, and when.

18. The costs associated with each Work activity shall be the total of labor, material, equipment, including overhead and profit of Contractor. The sum of the costs for all activities shall equal the total Contract value.

19. Include an identify code for each activity corresponding to either the Contractor or Subcontractor responsible for performing the Work.

20. Identify the Work activities that constitute the critical path. No more than twenty-five (25%) of the activities shall be critical or near critical. Near critical is defined as float in the range of one (1) to seven (7) calendar days.

21. Include at least twenty (20) workdays for the combined durations of all activities related to developing punch list(s), completion of punch list items and final clean-up for the Work or any designated portion thereof. No other activities shall be scheduled during this period. Refer to Section 01770, Contract Closeout Procedures for specific activities required.

22. Show detailed Subcontractor Work activities. In addition, furnish copies of Subcontractor schedules upon which Master CPM Schedule was built.

a. Also furnish for each Subcontractor, as determined by District, submitted on Subcontractor letterhead a statement certifying that Subcontractor concurs with Contractor’s Master CPM Schedule, and that Subcontractor’s related schedules have been incorporated.

b. Subcontractor schedules shall be independently derived and not a copy or subset of the Contractor’s Master CPM Schedule.

c. Furnish schedule for Contractor/Subcontractor CPM schedule meetings which shall be held prior to submission of Master CPM Schedule to District. District shall be permitted to attend scheduled meetings as an observer.

21. Submit a list of anticipated non-Work days, such as weekends, holidays, and/or other observances.

D. Seasonal weather conditions (which do not constitute a delay as defined herein) shall be considered in the planning and scheduling of all work influenced by high or low ambient temperatures or presence of high moisture for the completion of the Work within the allotted Contract Time. See Section 01305 (Delay and Extensions to the Work.)
E. Failure by Contractor to include any element of Work required for performance of the Work on any Project schedule shall not excuse Contractor from completing all Work required within the Contract Time.

F. Contractor shall schedule all deferred approval items and shop drawings in its schedules if appropriate. If Contractor fails to include deferred approval items and shop drawings in its schedule which results in a critical path delay, then Contractor shall be subject to the assessment of liquidated damages.

G. CPM Logic Requirements

1. The Project Schedule interval shall extend from NTP date to the required Contract Substantial and Final Completion dates. The Contract completion activity (End Project) shall finish based on the required contract duration in the Contract Documents, as adjusted for any approved contract time extensions. The first scheduled work period shall be the day after NTP is acknowledged by the Contractor. Schedule activities on a calendar to which the activity logically belongs. Activities may be assigned to a 7 day calendar when the contract assigns calendar day durations for the activity such as a District acceptance activity if the Contract Documents specify Calendar Days. If the Contractor intends to perform physical work less than seven days per week, schedule the associated activities on a calendar with non-work periods identified including weekends and holidays. Assign the Category of Work Code – Weather Sensitive Installation to those activities that are weather sensitive. Original durations must account for anticipated normal adverse weather. The District will interpret all work periods not identified as nonwork periods on each calendar as meaning the Contractor intends to perform work during those periods.

2. The Project Schedule shall start no earlier than the date on which the NTP was acknowledged. Include as the first activity in the Project Schedule an activity called "Start Project"(or NTP). The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero-day duration

3. Project Schedule Constraints and Open Ended Logic Constrain completion of the last activity in the Project schedule by the Contract Final Completion date. Schedule calculations shall result in a negative float when the calculated early finish date of the last activity is later than the Contract Final Completion date. Include as the last activity in the Project Schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the Contract Final Completion date for the Project, with a zero day duration, or shall achieve the same result by using the "project must finish on" date in the scheduling software. The Project Schedule shall have no constrained dates other than those specified in the Contract. The use of artificial float constraints such as "zero fee float" or "zero total float" are prohibited unless the Contractor specifically requests preapproval and receives District approval of this constraint on an activity specific level. There shall only be 2 open ended activities: Start Project (or NTP) with no predecessor logic and End Project with no successor logic.

4. In the event the Initial CPM schedule or Master CPM Schedule calculates an early completion date of the last activity prior to the Contract Final Completion date, the Contractor shall identify those activities that it intends to accelerate and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. The last activity shall have a late
finish constraint equal to the Contract Final Completion date and the schedule will calculate positive float. The District will not approve an early completion Project Schedule with zero float on the longest path. The District is under no obligation to accelerate activities for which it is responsible to support a proposed early contract completion.

5. Interim Completion Dates. Constrain contractually specified interim completion dates to show negative float when the calculated early finish date of the last activity in that phase is later than the specified interim completion date.

6. Start Phase. Include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and zero day duration.

7. End Phase. Include as the last activity for a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" Constraint date equal to the specified completion date for that phase and a zero day duration.

8. Phase "X" Hammock. Include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" hammock activity shall be logically tied to the earliest and latest activities in the phase.

9. Default Progress Data Disallowed. Do not automatically update Actual Start and Finish dates with default mechanisms that may be included in the scheduling software. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process shall match those dates provided from Daily Reports. Failure of the Contractor to document the AS and AF dates on the Daily Report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's updated Master CPM Schedule and the inability of the District to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Disable program features which calculate one of these parameters from the other.

10. Other Logic Requirements:

   a. Activities that have progressed before all preceding logic has been satisfied (Outof-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the District. Propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated Project Schedule. Correct out of sequence progress that continues for more than two update cycles by logic revision, as approved by the District.

   b. Lag durations contained in the project schedule shall not have a negative value. Do not use Start to Finish (SF) relationships.

   c. Project Schedule calculations shall retain the logic between predecessors and successors even when the successor activity starts and the predecessor activity has not finished. Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") will not be allowed.

11. Milestones. The Project Schedules must include milestone activities for each significant project event including but not limited to: All phases, foundation/substructure construction
complete; superstructure construction complete; building dry-in or enclosure complete to allow the initiation of finish activities; permanent power complete; and building systems commissioning complete (for each applicable phase of Work).

1.8 INITIAL CRITICAL PATH METHOD (CPM) SCHEDULE

A. Within ten (10) calendar days following Notice to Proceed, Contractor shall submit an Initial CPM Schedule along with a Initial Schedule of Values for District’s approval.

B. Within ten (10) calendar days following Notice to Proceed, Contractor shall submit a cost curve based on the Initial CPM Schedule and the Initial Schedule of Values, showing the cumulative estimated payments for all of the Work for the entire period of performance;

C. District and Contractor shall meet to review and discuss the Initial CPM Schedule within five (5) working days after it has been submitted to District.
   1. District's review and comment on the Initial CPM schedule shall be limited to conformance with the Contract Documents (with Work phasing, sequencing, coordination, milestone requirements, and specified formatting and information requirements) and accepted CPM principals.
   2. Contractor shall make corrections to the Initial CPM Schedule as necessary to comply with Contract requirements and shall adjust the schedule to incorporate any missing information as requested by District. Contractor shall resubmit the Initial CPM Schedule if requested by District.

D. Initial CPM Schedule must indicate detailed plan for the Work to be completed during the first sixty (60) days of the Contract, including details of planned mobilization of plant and equipment, the sequence of early operations, and the procurement of materials and equipment. Show Work beyond ninety (90) calendar days in summary form through the Contract Substantial and Final Completion dates.

E. Initial CPM Schedule shall be time-scaled.

F. The Initial CPM Schedule shall be cost loaded based on the Initial Schedule of Values as approved by District and Architect.

G. The accepted Initial CPM Schedule will be used as basis for initial payments until acceptance of the Master CPM Schedule by District. Use of the Initial CPM Schedule for progress payments shall not exceed sixty (60) calendar days.

H. If, during the first thirty (30) days after Notice-to-Proceed, the Contractor is of the opinion that any of the Work included on its Initial CPM Schedule has been impacted, the Contractor shall submit to District a written Time Impact Evaluation (TIE) in accordance with the requirement of this Section. The TIE shall be based on the most current update of the initial CPM Schedule.

1.9 MASTER CPM SCHEDULE
A. Within fifteen (15) calendar days from approval of the Initial CPM Schedule, Contractor shall submit a detailed Master CPM Schedule, including cost loading, presenting an orderly and realistic plan for completion of the Work, in conformance with requirements specified herein.

B. Failure of the Master CPM Schedule to include any element of the Work or any inaccuracy in the Master CPM Schedule will not relieve Contractor from responsibility for accomplishing the Work in accordance with the Contract.

C. District’s acceptance of the Master CPM Schedule shall be for its use in monitoring and evaluating job progress, payment requests, and time extension requests, and shall not, in any manner, impose a duty of care upon District, or act to relieve Contractor of its responsibility for means and methods of construction.

D. Contractor shall, within 10 calendar days from the Submittal of the Master CPM Schedule, shall meet with District to review the Master CPM Schedule submittal.

1. Contractor shall have its Construction Manager, Project Superintendent, Project Scheduler, and key Subcontractor representatives, as required by District, in attendance. The meeting will take place over a continuous one-day period.

2. District’s review will be limited to submittal's conformance to Contract requirements. Review may also include:
   a. Critical path method principles and tenets utilized
   b. Clarifications of Contract Requirements
   c. Directions to include activities and information missing from the submittal
   d. Requests to Contractor to clarify its schedule

3. Within five (5) days of the Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by District at the Meeting.

1.10 ADJUSTMENTS TO THE MASTER CPM SCHEDULE

A. Contractor shall revise the Master CPM Schedule submittal to address all review comments from the review meeting described above, and resubmit the Master CPM Schedule for District review and approval.

1. District, within ten (10) days from date that Contractor submitted the revised Master CPM schedule, will either:
   a. Accept the Master CPM Schedule as submitted, or
   b. Advise Contractor in writing to review any part or parts of the Master CPM Schedule which either do not meet Contract requirements, or are unsatisfactory for District to purposes of monitoring Project progress, resources, and status, or to evaluate monthly payment request by Contractor.

2. District may accept the Master CPM Schedule with conditions that the first monthly update of the Master CPM schedule will be revised to correct identified deficiencies.

3. When the Master CPM Schedule is accepted, it shall be considered the Master CPM Schedule, which will then be immediately updated to reflect the current status of the work.

4. District reserves right to require Contractor to adjust, add to, or clarify any portion of Master CPM Schedule which may later be discovered to be insufficient for monitoring the Work or approving payment requests. No additional compensation will be due to the Contractor for any such adjustments, additions, or clarifications.
B. Acceptance of Contractor's Master CPM Schedule by District will be based upon schedule's compliance with Contract requirements and accepted CPM principles.

1. In assigning activity durations and proposing Work sequences, Contractor agrees to utilize sufficient and necessary management and other resources to perform work in accordance with the approved Master CPM Schedule.

2. Upon submittal and District approval of any Master CPM Schedule Update, such updated schedule shall then be considered the "current" Master CPM Schedule.

3. Submission of Contractor's Master CPM Schedule to District shall not relieve Contractor of total responsibility for scheduling, sequencing, and executing the Work to comply with requirements of Contract Documents, including recovery from adverse effects such as delays resulting from ill-timed work.

C. Submittal of the Master CPM Schedule, and subsequent Updates shall be understood to be the Contractor's representation that the Master CPM Schedule meets all requirements of Contract Documents, and that the Work shall be executed in the sequence and within the time indicated on the schedule.

D. Contractor shall distribute the Master CPM Schedule to Subcontractors for review and written acceptance, which shall be noted on Subcontractors' letterhead to Contractor and transmitted to District for the Project record.

1.11 MASTER CPM SCHEDULE MONTHLY UPDATES

A. Following acceptance of Contractor's Master CPM Schedule, Contractor shall monitor the progress of Work and adjust the Master CPM Schedule each month to reflect actual progress, and to illustrate any anticipated changes to planned activities.

1. Each Master CPM Schedule Update submitted by Contractor shall be complete, including all information requested for the original Master CPM Schedule submittal.

2. Each Master CPM Schedule Update submitted by Contractor shall continue to show all work activities including those already completed. Any completed activities shall accurately reflect "as built" information by indicating when Work activities were actually started and completed. Contractor shall warrant the accuracy of as-built information shown on each Master CPM Schedule Update.

B. A meeting will be held within the first week of each month with the District and Project Inspector to review the Master CPM Schedule Update submittal and progress payment application for the previous month. Conduct periodic schedule update meetings for the purposes of reviewing the Contractor's proposed out of sequence corrections, determining causes for delay, correcting logic, maintaining schedule accuracy and determining earned value. Provide a computer with the scheduling software loaded and a projector during the meeting which allows all meeting participants to view the proposed Master CPM Schedule Update during the meeting. The meeting and resultant approvable Master CPM Schedule Update shall be a condition precedent to a formal submission of the Master CPM Schedule Update and to the submission of an invoice for payment. The meeting will be a working interactive exchange which will allow the District and the Contractor the opportunity to review the Master CPM Schedule Update on a real time and interactive basis. The Contractor's authorized scheduling
representative will organize, sort, filter and schedule the update as requested by the District. A rough draft of the proposed activity logic corrections and narrative report shall be provided to the District 48 hours in advance of the meeting.

1. At this monthly meeting, a minimum requirement for review shall be included, but not limited to the following items:
   a. Percent complete of each Work activity
   b. Time impact evaluations for Change Orders and Time Extension Requests, if any
   c. Actual and anticipated Work activity sequence changes
   d. Anticipated Work activity duration changes
   e. Actual and anticipated Contractor delays

2. These meetings are a critical component of overall monthly Master CPM Schedule Update submittal and Contractor shall ensure appropriate personnel attend. At a minimum, Contractor's Project Engineer, General Superintendent, and Scheduler shall attend these meetings.

3. Status of Activities. Update information, including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete shall be subject to the approval of the District at the meeting. As a minimum, address the following items on an activity by activity basis during each progress meeting.
   a. Start and Finish Dates. Accurately show the status of the AS and/or AF dates for each activity currently in-progress or completed since the last update. The District may allow an AF date to be assigned with the percent complete less than 100% to account for the value of work remaining but not restraining successor activities. Only assign AS dates when actual progress occurs on an activity.
   b. Remaining Duration. Update the estimated RD for all incomplete activities independent of Percent Complete. Remaining Durations may exceed the activity original duration (OD) or may exceed the activity's prior update RD if the District considers the current OD or RD to be understated based on current progress, insufficient work crews actually manning the job, unrealistic OD or deficiencies that must be corrected that restrain successor activities.
   c. Percent Complete. Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work, and which do not restrain the initiation of successor activities, may be declared 100 percent complete. To allow for proper schedule management, cost load the correction of punch list from District pre-final inspection activity(ies) for each phase not less than 1 percent of the total value of that phase, which activity(ies) may be declared 100 percent complete upon completion and correction of all punch list work identified during District's pre-final inspection(s).
   d. Logic Changes. Specifically identify and discuss all logic changes pertaining to NTP on change orders, change orders to be incorporated into the Master CPM Schedule Update, Contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, and other changes that have been made pursuant to contract provisions. The District will only approve logic revisions for the purpose of keeping the schedule valid in
terms of its usefulness in calculating a realistic completion date, correcting erroneous logic
ties, and accurately sequencing the work.

e. Other Changes. Other changes required due to delays in completion of any activity or
  group of activities include: 1) delays beyond the Contractor's control, such as strikes and
  unusual weather. 2) delays encountered due to submittals, District activities, deliveries or
  work stoppages which make re-planning the work necessary.

3. Changes required to correct a Master CPM Schedule Update that does not represent the
  actual or planned prosecution and progress of the Work.

H. Within five (5) working days after monthly schedule update meeting, Contractor shall submit
  the updated Master CPM Schedule Update.

D. Within five (5) work days of receipt of above noted revised submittals, District will either
  accept or reject monthly Master CPM Schedule Update submittal.
  1. If accepted, percent complete shown in monthly update will be basis for Application for
     Payment by the Contractor. The schedule update shall be submitted as part of the
     Contractor's Application for Payment.
  2. If rejected, update shall be corrected and resubmitted by Contractor before the Application
     for Payment is submitted.
  3. District and Architect will not review Contractor's application for payment if the updated
     monthly Master CPM Schedule Update is not provided and accepted by District.

E. Neither updating, changing or revising of any report, curve, schedule or narrative submitted by
  Contractor under this Contract, nor District's review or acceptance of any such report, curve,
  schedule or narrative, shall have the effect of amending or modifying in any way the Contract
  Substantial or Final Completion date or any phase completion dates, or of modifying or limiting
  in any way Contractor's obligations under this Contract.

F. Updating the Master CPM Schedule to reflect actual progress shall not be considered revisions
to the Project Schedule.

G. To clarify any revisions to the Master CPM Schedule Update, the Contractor shall provide District
  with a written narrative explaining the reasons for each Work activity revision. For revisions
  affecting the sequence of work, the Contractor shall provide a schedule diagram which
  compares the original sequence to the revised sequence of work. The Contractor shall
  provide the written narrative and schedule diagram for revisions two (2) working days in
  advance of the monthly Master CPM Schedule Update meeting.

H. Schedule revisions shall not be incorporated into any Master CPM Schedule Update until the
  revisions have been reviewed and approved by District. District may request further information
  and justification for Master CPM Schedule revisions. Contractor shall, within three (3) days of
  any such District request, provide District with a complete written narrative response.
H. If the Contractor’s revision is still not accepted by District, and the Contractor disagrees with District’s position, the Contractor has three (3) work days from receipt of District’s letter rejecting the revision to provide a written narrative providing full justification and explanation for the revision. The Contractor’s failure to respond in writing within three (3) work days of District’s written rejection of a schedule revision shall be contractually interpreted as acceptance of District’s position, and the Contractor waives its rights to subsequently dispute or file a claim regarding District’s position.

J. At District’s discretion, the Contractor may be required to provide subcontractor(s) certifications of Work activity performance regarding any proposed Master CPM Schedule revisions affecting said subcontractor(s).

1.12 WEEKLY LOOK AHEAD SCHEDULE

A. At each Weekly Progress Meeting, the Contractor shall provide and present a time scaled three (3) week schedule: one (1) week behind and two (2) week look ahead schedule that is based on and correlated by activity number in the current Master CPM Schedule Update. Provide a two week look ahead schedule in bar chart format, showing daily activities for that period.

1.13 OTHER SCHEDULE RELATED REPORTS

A. Submit four (4) hard copies of the following reports with the Initial CPM Schedule, the Master CPM Schedule, and with each monthly update of the Master CPM Schedule:

1. Two (2) activity-listing reports: one report sorted by activity number and one report by total float. These reports shall also include each activity’s early/late and actual start and finish dates, original and remaining duration, float, responsibility code and the logic relationship of activities.

2. Cost report sorted by activity number including each activity’s associated cost, percentage of Work accomplished, earned value to-date, previous payments and amount earned for current update period.

3. Schedule plots presenting time scaled network diagram showing activities and their relationships with the controlling operations or critical path clearly highlighted.

4. Cash flow report calculated by early start, late start and indicating actual progress. Provide an exhibit depicting this information in graphic form.

5. Monthly status report, to include:
   a. Status of major Project components (percent complete, amount of time ahead or behind schedule) and an explanation of how Project will be brought back on schedule if delays have occurred.
   b. Progress made on critical activities indicated on Project Schedule.
   c. Explanations for any lack of work on critical path activities planned to be performed during last month.
   d. Explanations for any schedule changes, including changes to logic or to activity durations.
   e. List of critical activities scheduled to be performed next month.
   f. Status of major material, and equipment procurement.
g. Any delays encountered during reporting period.
h. Contractor may include any other information pertinent to status of Project. Contractor shall include additional status information requested by District at no additional cost.
i. Status reports, and the information contained therein, shall not be construed by the Contractor as claims, notice of claims, notice of delay, or requests for changes or compensation.

B. Furnish DISTRICT with digital files of all reports and Master CPM Schedule Updates on labeled CD ROM

1.14 RECOVERY SCHEDULE

A. If any Master CPM Schedule Update shows that the Contract Substantial Completion date is five (5) calendar days beyond the Contract Substantial Completion date, the Contractor shall submit to District proposed schedule revisions to recover the lost time within seven (7) calendar days. As part of this Recovery Schedule submittal, the Contractor shall provide a written narrative for each schedule revision made to recapture the lost time. If the revisions include sequence changes, the Contractor shall provide a schedule diagram comparing the original sequence to the revised sequence of work.

B. Recovery Schedule revisions shall not be incorporated into any Master CPM Schedule Update until the revisions have been reviewed and approved by the District.

C. If the Contractor’s Recovery Schedule revisions are not accepted by District, District and the Contractor shall follow the procedures in paragraph 1.10 H through J, above.

D. If requested by District, Contractor shall provide revised schedules within ten (10) days if, at any time, the District consider the completion date to be in jeopardy because of activities that are behind schedule. The additional schedule shall include a new arrow or precedence diagram and schedule reports conforming to the requirements herein, designed to show how the Contractor intends to accomplish the Work to meet the completion date.

E. The Contractor shall modify any portions of the schedule that become infeasible because of “activities behind schedule” or for any other valid reason. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule.

1.15 TIME IMPACTS EVALUATION (TIE) FOR CHANGE ORDERS AND OTHER POTENTIAL DELAYS

A. When Contractor is directed to proceed with changed Work, which the Contractor considers have a time impact, the Contractor shall prepare and submit, within seven (7) calendar days from the direction to proceed, a Time Impact Evaluation (TIE) which includes both a written narrative and a schedule diagram depicting how the changed work affects other schedule activities. The schedule diagram shall show how the Contractor proposes to incorporate the changed Work in the schedule, and how it impacts the current Master CPM Schedule and critical path. The Contractor is responsible for requesting time extensions based on the TIEs impact on
the critical path. The diagram must correspond to the main sequences of Work activities in the current Master CPM Schedule, to enable District to evaluate time impact of changed work to the scheduled critical path.

B. Contractor shall be required to comply with the above requirements for all types of delays such as, but not limited to, Contractor/Subcontractor delays, adverse weather delays, strikes, procurement delays, fabrication delays, etc.

C. Contractor shall be responsible for all costs associated with the preparation of Time Impact Evaluations, and the process of incorporating them into the current schedule update. The Contractor shall provide District with 3 copies of each TIE.

D. Once agreement between District and Contractor has been reached on a TIE, the Contract time will be adjusted accordingly. If agreement is not reached on a TIE, the Contract time may be extended in an amount District allows, and the Contractor may submit a claim for additional time.

E. If the Contractor does not submit a TIE within the required seven (7) calendar days for any issue, it is mutually agreed that the Contractor does not require a time extension for said issue.

1.16 TIME EXTENSIONS

A. The Contractor is responsible for requesting time extensions for time impacts that, in the opinion of the Contractor, impact the critical path of the current Master CPM Schedule.

B. Contractor shall not be granted an extension of time for failure to obtain necessary approvals for deferral approvals due to failure to comply with laws, building codes, and other regulations (including Title 24 of the California Code of Regulations).

C. No time extensions will be granted under this Contract for the cumulative effect of changes in the Work.

D. District will not be obligated to consider any time extension request unless requirements of Contract Documents have been met.

E. Failure of the Contractor to perform in accordance with the current Master CPM Schedule Update shall not be excused because of submittal of a time extension request.

F. Where an event for which District is responsible impacts the projected Contract Substantial Completion date of the Work, or any phase of the Work, the Contractor shall provide a written mitigation plan, including a schedule diagram, which explains how (e.g., increase crew size, overtime, etc.) the impact can be mitigated. The Contractor shall also include a detailed cost breakdown of the labor, equipment, and material the Contractor would expend to mitigate District caused time impact. The Contractor shall submit its mitigation plan to District within seven (7) calendar days from the date of discovery of said impact. The Contractor is responsible for the cost to prepare the mitigation plan.

G. Contractor’s failure to a request time extension, provide a TIE, or provide the required mitigation plan will result in Contractor waiving its right to both a time extension and to recovering any costs to mitigate the delay.
PART 2 - PRODUCTS
Not applicable to this section.

PART 3 - EXECUTION
Not applicable to this section.

END OF SECTION 01310
SECTION 01311
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01010 – “Summary of Work”
B. Section 01140 – “Work Restrictions”
C. Section 01312 – “Project Meetings”
D. Section 01330 – “Submittal Procedures”
E. Section 01411 – “Testing Laboratory Services”
F. Section 01416 – “Special Procedures”
G. Section 01505 – “Construction Waste Management”
H. Section 01540 – “Site Security and Safety”
I. Section 01770 – “Contract Closeout Procedures”
J. Section 01820 – “Demonstration & Training”
K. Divisions 2 through 33 Sections for Project Management and Coordination requirements for the work in those Sections.

1.3 SUMMARY

A. This Section specifies the administrative requirements and includes descriptions of required Project Coordination for the work and all phases of Project including, but not limited to, the following:
1. Coordination
2. Pre-Construction Conference
3. Project Meetings
4. Pre-installation Conferences-Coordination
5. Underground and Utilities Coordination
6. Electrical and Mechanical Coordination
7. Coordination with Work by District
8. Special Meetings-Coordination
9. Coordination of Contract Closeout
1.4 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of Work, with provisions for accommodating items to be installed later and for accommodating items to be installed by other District Contractors.

B. Resolve differences or disputes concerning coordination, interference, or extent of Work of the various Sections of the Specifications. Contractor’s decisions if consistent with requirements of the Contract Documents shall be final.

C. Coordinate completion and clean-up of Work of separate Sections in preparation for substantial Completion.

D. Coordinate requests for substitutions to assure compatibility of space, of operating elements, and effect on work of other sections.

E. Coordinate sequence of Work to accommodate District occupancy as specified within the Contract Documents. Cooperate with District and District suppliers and/or contractors during move-in and occupancy of the completed Work at each Phase.

F. Contractor shall coordinate construction operations and means, and method of construction included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Coordinate structural, mechanical, and electrical elements prior to installation. All penetrations of structural elements must first receive approval of Architect and District. Rerouting of ductwork, piping, or conduit and resulting changes to other work caused by failure to coordinate beforehand is the responsibility of the Contractor and shall not be considered justification for either additional cost or time.
   2. Schedule construction operations in sequence required to obtain the best constructed results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   3. Coordinate installation of different components with other contractors or other trades to ensure maximum and appropriate accessibility for required maintenance, service, and repair. Where availability of space is limited, coordinate installation of different components to ensure maximum and appropriate performance and accessibility for required maintenance, service, operations, and repair of all components, and building systems.
   4. Make adequate provisions to accommodate items scheduled for later installation.
   5. The manner in which the Specifications are divided into Divisions and Sections is not intended to indicate division of work between trades nor indicate trade union or jurisdictional agreements. Requests for an increase in the Contract Price or Time for Work indicated in one area of the Specifications or Drawings that are not correlated with Work indicated in other areas of the Specifications or Drawings before Bidding will be denied by the District.
      a. Assign and subcontract construction activities and employ workers in a manner that will not risk jurisdictional disputes that could result in conflicts, delays, claims, or losses.
1.5 PRECONSTRUCTION CONFERENCE
   A. The District will schedule a conference after Notice to Proceed and prior to the start of Work.
   B. Attendance Required: District representatives, Architect and consultants, DSA Project Inspector, District Representative, Contractor, certain Subcontractors as requested by the District and others as appropriate.

1.6 ADMINISTRATIVE COORDINATION
   A. Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative coordination activities include, but are not limited to, the following:
      1. Preparation of and coordination of Contractor’s CPM Schedules Preparation of the Schedule of Values and Master CPM Schedule
      2. Coordinate installation and removal of temporary facilities and controls
      3. Coordinate and delivery and processing of submittals, and samples
      4. Coordinate progress meetings, testing, and inspection
      5. Pre-installation conferences
      6. Mockups
      7. Startup and adjustment of systems
      8. Project closeout activities
   B. Project Documents Management and Exchange

1.7 PRE-INSTALLATION CONFERENCES AND COORDINATION
   A. Contractor shall be responsible to convene pre-installation conferences as required by individual Section of the Specifications. Include all affected parties. Also refer to Section 01312 for additional Project Meetings and Coordination requirements.

1.8 COORDINATION OF THE WORK
   A. Coordinate use of project space and sequence of installation of mechanical, electrical, structural, and other Work which is indicated diagrammatically on Drawings. Follow routings shown for pipes, ducts, and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently for maximum and appropriate accessibility for other installations, for maintenance, service, operations, and for repairs.
   B. Contractor shall use large scale drawings, if their preparation is required as part of Work of these specifications, together with shop drawings and layout drawings of other affected sections of these specifications to check, to coordinate, and to integrate the Work of various sections to prevent interferences.
C. Perform and complete checking and coordination before commencing construction in the affected areas.

D. In finished areas, except as otherwise shown, conceal pipes, ducts, and wiring in the construction. Coordinate locations of plumbing, fixtures, electrical fixtures, and fixtures and outlets with finish elements.

1.9 CONSERVATION

A. Contractor shall coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as District’s property.

1.10 MEANS AND METHODS

A. Contractor is solely responsible for construction means, methods, techniques, sequences, and procedures for performing all Work.

1.11 COORDINATION KEY PERSONNEL NAMES

A. Contractor prior to starting construction operations shall submit a list of key personnel assignments, including Contractor’s Project Manager, Superintendent, Assistant Superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including office and cell telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Contractor shall submit (10) copies of key personnel list to the District.

2. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times and provide current list to the District.

1.12 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. Contractor shall provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include specific or dedicated personnel required for coordination of operations with other contractors.

1.13 COORDINATION WITH WORK BY DISTRICT

A. Coordinate service connections for District furnished and District installed equipment. Verify that service connections are correct sizes and in required locations.

B. Coordinate support and anchorage for equipment furnished and installed by the District. Provide blocking and backing as shown or directed to facilitate installation of equipment by others.
1.14 DAILY CONSTRUCTION REPORTS

A. On a daily basis, Contractor shall submit a daily activity report to DISTRICT for each workday, including weekends and holidays, when worked. Contractor shall develop the daily construction reports on a computer-generated data-base capable of sorting daily Work, manpower and man-hours by Contractor, Subcontractor, area, sub area, and change order work. Upon request of DISTRICT, furnish computer disk of this database. Obtain DISTRICT’s written approval of daily construction report data base format prior to implementation. Include in report:

1. Project name and Project number
2. Contractor’s name and address
3. Weather, temperature and any unusual site conditions
4. Brief description and location of the day’s scheduled activities and any special problems and accidents, including Work of Subcontractors. Descriptions shall be referenced to CPM scheduled activities.
5. Worker quantities for its own Work force and for Subcontractors of any tier.
6. Equipment, other than hand tools, utilized by Contractor and Subcontractors.

1.15 PERIODIC VERIFIED REPORTS

A. The Contractor shall complete and submit the Final Verified Report required by DSA in addition to other conditions precedent to Final Payment, the Contractor’s completion and submission of the Final Verified Report is an express condition precedent to the District’s obligation to make the Final Payment. In addition to completion and submission of the Final Verified Report, as a material obligation under the Contract Documents, the Contractor shall comply will all DSA requests for reports or other data relating to the Work, the status thereof or conformity of the Work to the Contract Documents.

PART 2 - PRODUCTS
Not Used.

PART 3 - EXECUTION
Not Used.

END OF SECTION 01311
SECTION 01312
PROJECT MEETINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01010 – “Summary of Work”
B. Section 01140 – “Work Restrictions”
C. Section 01400 – “Quality Control Requirements”
D. Section 01500 – “Temporary Facilities and Control”
E. Section 01770 – “Contract Closeout Procedures”
F. Divisions 2 through 33 Sections for Project Meetings requirements for the work in those Sections.

1.3 SUMMARY

A. This Section specifies administrative requirements and provides descriptions of the required project meetings for the Work and all phases of the project. These meetings include, but not limited to, the following:
   1. Preconstruction Meeting
   2. Schedule Review Meetings
   3. Weekly Project Progress Meetings
   4. Progress Schedule and Application for Payment Meetings
   5. Special Meetings

1.4 PRECONSTRUCTION CONFERENCE

A. District will schedule and conduct the Preconstruction Conference at a time and place to be determined.

B. Contractor and all major subcontractors shall attend the Preconstruction Conference. This includes, but is not limited to, the following:
   1. Demolition Subcontractor
   2. Structural Steel Subcontractor
   3. Mechanical Subcontractor
   4. Electrical Subcontractor
   5. Plumbing Subcontractor
   6. Hazardous Material Abatement Subcontractor
C. Meeting agenda will include, but is not limited to, discussion of the following items:

- 1. Schedules
- 2. Personnel and vehicle permit procedures
- 3. Use of premises
- 4. Location of Contractor’s On-Site facilities
- 5. Security
- 6. Housekeeping
- 7. Submittal and RFI procedures
- 8. Inspection and testing procedures, on-Site and off-Site
- 9. Utility shutdown procedures
- 10. Control and reference point survey procedures
- 11. Injury and Illness Prevention Program
- 12. Initial Schedule
- 13. Schedule of Values
- 14. Schedule of Submittals
- 15. Project Directory
- 16. Emergency Contact List

1.5 SCHEDULE OF VALUES and initial schedule MEETING

A. Contractor shall meet with District and Architect within 10 days of submittal of the initial Schedule of Values and Initial CPM Schedule to review and evaluate the Schedule of Values and the Initial CPM Schedule.

1.6 SHOP DRAWINGS & SUBMITTALS SCHEDULE MEETING

A. Contractor shall meet with District and Architect within 10 days of submittal of the draft Shop Drawings and Submittals Schedule to review and evaluate the Shop Drawings and Submittals Schedule.

1.7 WEEKLY PROGRESS MEETINGS

A. Weekly Progress Meetings will be scheduled throughout duration of Work and all phases of the project at a time acceptable to the District. Progress meetings will be held weekly, unless otherwise directed by District.

1. Meetings shall be held at Project Manager’s on-site office trailer unless otherwise directed by the District.

2. The District Representative will record meeting notes of the Weekly Progress Meeting. Within 3 working Days after the meeting, the District Representative will distribute minutes to District via e-mail, and to those affected by decisions made at the meeting. Attendees can either submit comments or additions to the minutes within 3 working days. The minutes will constitute a final documentation of the results of meeting.

B. Progress meetings shall be attended by the Contractor’s project manager, project engineer, and job superintendent, District Representative, Architect and Engineers, the Inspector of Record, and others as appropriate to agenda topics for each meeting.
C. Agenda: The previous week meeting minutes will be used as the agenda for the subsequent meeting, with new business discuss for each agenda item.

1.8 BILLING MEETINGS
A. See Section 01290, Payment Procedures.

1.9 SPECIAL MEETINGS
A. Contractor or District may call special meetings by notifying the desired participants. Notify District no less than 5 work days in advance and provide the reason for the meeting. Special meetings may be held without advance notice in emergency situations.

B. At any time during the progress of Work, District shall have authority to require Contractor to attend a meeting with any or all of the Subcontractors engaged in the Work or in other work and notice of such meeting shall be duly observed and complied with by Contractor.

C. Contractor shall schedule and conduct his own periodic coordination meetings as necessary to discharge coordination responsibilities.

D. Contractor shall give District five work day’s written notice of his coordination meetings. Contractors shall maintain and distribute minutes of coordination meetings to District. Attendees shall have three work Days to submit comments or additions to minutes. Minutes will constitute final documentation of results of coordination meetings.

1.10 GUARANTEES/WARRANTIES, BONDS, AND SERVICE & MAINTENANCE CONTRACTS REVIEW MEETING
A. Ten Months following date of final acceptance/completion, Contractor to hold a meeting to review guarantees/warranties, bonds, and service maintenance contracts for materials and equipment. Implement repair or replacement of defective items, and extend service and maintenance contracts, as desired by District.

B. Attending shall be:
   1. District Representatives
   2. Architect and Architect’s consultants, as appropriate
   3. DVC-Maintenance & Operations
   4. Contractor
   5. Subcontractors, as appropriate
   6. Others, as appropriate

END OF SECTION 01312
SECTION 01318

DOCUMENT MANAGEMENT SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

1.1.1 This Section is in addition to the requirements in the Contract General Conditions and General Specifications.

1.1.2 The District is utilizing the EADOC LLC’s EADDOC web-based system to aid in the document control, management and communications between the District, Architect, and Contractor. Therefore, the District and Contractor shall utilize EADOC LLC’s EADOC system for electronic submittal of all data and documents (unless otherwise specified or allowed by the District) throughout the duration of the Contract. EADOC is a web-based electronic media site that is hosted by EADOC LLC utilizing their EADOC web solution. EADOC will be made available to the Contractor’s project personnel, subcontractor personnel, suppliers, consultants and the Architect and their sub-consultants. The joint use of this system is to facilitate: electronic exchange of information, automation of key processes, and overall management of the Contract. EADOC shall be the primary means of project information submission and management. When required by the District elsewhere in these Specifications, paper documents will also be provided. In the event of discrepancy between the electronic version and paper documents, the paper documents will govern. EADOC is a registered trademark of EADOC LLC.

1.1.3 Preconstruction Meeting/Contractor Information: At the Preconstruction Meeting, the Contractor shall provide to the District the email addresses of all Contractor personnel that will be using the EADOC web-based system. At a minimum, this will include the Contractor’s Project Manager, General Site Superintendent and Project Engineer. These personnel shall have sufficient computer skills required to access, and process documents over the Internet.

1.2 USER ACCESS LIMITATIONS

The District will control the Contractor's access to EADOC by allowing access and assigning user profiles to accepted Contractor personnel. User profiles will define levels of access into the system; determine assigned function-based authorizations (determines what can be seen) and user privileges (determines what they can do). Sub-contractors and suppliers will be given access to EADOC through the Contractor. Entry of information exchanged and transferred between the Contractor and its sub-contractors and suppliers on EADOC shall be the responsibility of the Contractor.

1.3 AUTOMATED SYSTEM NOTIFICATION AND AUDIT LOG TRACKING

Review comments made (or lack thereof) by the District on Contractor submitted documentation shall not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for managing, tracking, and documenting the Work to comply with the requirements of the Contract Documents. District acceptance via automated system notifications or audit logs extends only to
the face value of the submitted documentation and does not constitute validation of the Contractor's submitted information.

1.4 SUBMITTALS

See Section 01330, Submittals for general submittal requirements.

1.5 COMPUTER REQUIREMENTS

The Contractor shall use computer hardware and software that meets the requirements of the EADOC system as recommended by EADOC LLC to access and utilize EADOC. As recommendations are modified by EADOC, the Contractor will upgrade their system(s) to meet the recommendations or better. Upgrading of the Contractor's computer systems will not be justification for a cost or time modification to the Contract. The Contractor will ensure that connectivity to the EADOC system (whether at the home office or job site) is accomplished through DSL, cable, T-1 or wireless communications systems. The minimum bandwidth requirements for using the system are 128kb/s. It is recommended the Contractor use a faster connection when uploading pictures and files into the system. EADOC currently supports Mozilla's Firefox v3.0-3.6, Apple’s Safari V3.0-5.0, and Microsoft’s Internet Explorer v7.0-8.0 web browsers for accessing the application.

1.6 CONTRACTOR RESPONSIBILITY

The Contractor shall be responsible for the validity of their information placed in EADOC and for the abilities of their personnel. Accepted users shall be knowledgeable in the use of computers, including Internet Browsers, email programs, cad drawing applications, and Adobe Portable Document Format (PDF) document distribution program. The Contractor shall utilize the existing forms in EADOC to the maximum extent possible. If a form does not exist in EADOC, the Contractor must include a form of their own, or use the forms provided or required by the District. Adobe PDF documents will be created through electronic conversion rather than optically scanned whenever possible. The Contractor is responsible for the training of their personnel in the use of EADOC (outside what is provided by the District), and the other programs indicated above as needed.

1.6.1 User Access Administration: Provide a list of Contractor's key EADOC personnel for the District’s acceptance. Contractor is responsible for adding and removing users from the system as it pertains to their personnel or the personnel of their subcontractors and/or suppliers. The District reserves the right to perform a security check on all potential users. The Contractor will be allowed to add additional personnel and subcontractors to EADOC.

16.2 EADOC RFI Sketch Attachments: Faxed copies or hand delivered RFI attachments (sketches, product information, etc.) will NOT be accepted. The Contractor shall scan and convert all RFIs sketches and other documents into PDF files. To perform this task, the Contractor shall procure and use Adobe Acrobat 9.0 and Adobe Pro X.

1.7 CONNECTIVITY PROBLEMS

EADOC is a web-based environment; therefore, subject to the inherent speed and connectivity problems of the Internet. The Contractor is responsible for its own connectivity to the Internet. EADOC response
time is dependent on the Contractor's equipment, including processor speed, Internet access speed, etc., and current traffic on the Internet. The District is not liable for any delays associated from the usage of EADOC including, but not limited to: slow response time, down time periods, connectivity problems, or loss of information. The Contractor will ensure that connectivity to the EADOC system (whether at the home office or job site) is accomplished through DSL, cable, T-1 or wireless communications systems. The Contractor’s minimum bandwidth requirements for using the system are 128kb/s. It is recommended a faster connection be used when uploading pictures and files into the system. Under no circumstances shall the usage of the EADOC be grounds for a time extension or cost adjustment to the Contract.

1.8  EADOC TRAINING AND SUPPORT

1.8.1  EADOC Training: The District has arranged for the following training that will be provided to the Contractor at no additional cost to the Contractor: Project Team Training, which includes one, 3-hour session on line. All other EADOC training or services desired by the Contractor, or its subcontractors, shall be at the expense of the Contractor. All District provided EADOC training for the Contractor will occur between the Notice of Award and the Notice to Proceed.

1.8.2  EADOC Support: EADOC will provide limited web support to the Contractor between the hours of 6:00 am and 6:00 pm, Pacific Standard Time. If requested by the Contractor, EADOC phone support or special support by EADOC shall be at the Contractor’s expense.

PART 2 PRODUCTS

2.1  Description

EADOC project management application (no equal) provided by EADOC LLC, www.EADOCsoftware.com

PART 3 EXECUTION

3.1  EADOC UTILIZATION

EADOC will be used for, but not limited to, all of the following documents. At the direction of the District, the Contractor may be required to post other documents that are not listed below over the course of the Project.

1. Submittals/Shop Drawings/Samples (by Contractor; response by District)
2. Submittal substitution requests (by Contractor; response by District)
3. Requests for Information (by Contractor; response by District)
4. Non-Compliance Reports (by District; response by Contractor)
5. Schedules (by Contractor; response by District)
6. Project Photographs (by Contractor)
7. Posting Weekly Project Meeting Minutes (by District)
8. Change Order Request (by Contractor; response by District)
9. Field Instructions (by District; response by Contractor)
10. Payment Requests (by Contractor; response by District)
11. Daily Reports (by Contractor)
12. Inspection and Special Inspection & Testing Requests (by Contractor)
13. Punch lists (By Contractor)
14. Architectural Supplemental Instructions (by District)
15. Memos (General and notices to District or Contractor)
16. Conformed Drawings and Specifications (Contract Documents may be posted by the District)

3.2. Additional Information Regarding Submittals, Shop Drawings, Samples, Etc.

All submittals, shop drawings, samples, etc. shall be submitted as PDF attachments to the EADOC submittal work flow process and form. See Section 01330 for specific submittal requirements, including paper submittals and copies.

3.2.1 Shop Drawings: Contractor shop drawing and design data documents shall be submitted as PDF attachments (in addition to the hard copies requested) to the EADOC submittal work flow process and form. Examples of shop drawings include, but are not limited to:
   a. Standard manufacturer installation drawings.
   b. Drawings prepared to illustrate portions of the work designed or developed by the Contractor.
   c. Steel fabrication, piece, and erection drawings.

3.2.2 Product Data: Product catalog data and manufacturer’s instructions shall be submitted as PDF attachments (in addition to the hard copies requested) to the EADOC submittal work flow process and form. Examples of product data include, but are not limited to:
   a. Manufacturer’s printed literature.
   d. Preprinted product specification data and installation instructions.

3.2.3 Samples: Sample submittals shall be physically submitted as specified in Section 01330. Contractor shall enter submittal data information into EADOC with a copy of the submittal form(s) attached to the sample. Examples of samples include, but are not limited to:
   a. Product finishes and color selection samples.
   b. Product finishes and color verification samples.
   c. Finish/color boards.
   d. Physical samples of materials.

3.2.4 Administrative Submittals: All correspondence and pre-construction submittals shall be submitted using EADOC. Examples of administrative submittals include, but are not limited to:
   a. Digging permits and notices for excavation.
   b. SWPPP reports.
   c. List of product substitutions
   d. List of contact personnel.
   e. Notices for roadway interruption, work outside regular hours, and utility cutovers.
   f. Schedules and associated reports and updates. Each schedule submittal specified in Specification Section 01320 shall be submitted as a native backed-up file (.PRX or .STX) of the
scheduling program being used. The schedule will also be posted as a PDF file in the format specified in Specification Section 01320.
g. Plans for safety, demolition, environmental protection, and similar activities.
h. Quality Control Plan(s), Testing Plan and Log, Quality Control Reports, Production Reports, Quality Control Specialist Reports, Preparatory Phase Checklist, Initial Phase Checklist, Field Test reports, Summary reports, Rework Items List, etc.
i. Meeting minutes for quality control meetings, progress meetings, pre-installation meetings, etc.
j. Any general correspondence submitted.

3.2.5 Compliance Submittals: Test reports, certificates, and manufacturer field report submittals shall be submitted on EADOC as PDF attachments. Examples of compliance submittals include, but are not limited to:
a. Field test reports.
b. Quality Control certifications.
c. Manufacturer’s documentation and certifications for quality of products and materials provided.

3.2.6 Record and Closeout Submittals
Operation and maintenance data and closeout submittals shall be submitted on EADOC as PDF documents during the approval and review stage as specified, with actual set of documents submitted for final. Examples of record submittals include, but are not limited to:
a. Operation and Maintenance Manuals: Final documents shall be submitted as specified.
b. As-Built Drawings: Final documents shall be submitted as PDF and hard copy.
c. Extra Materials, Spare Stock, etc.: Submittal forms shall indicate when actual materials are submitted.

3.2.7 Financial Submittals: Schedule of Values, Progress Payment Requests and Change Order Requests shall be submitted on EADOC. Supporting material for Pay Requests and Change Order Requests shall be submitted on EADOC as PDF attachments. Examples of compliance submittals include, but are not limited to:
a. Contractor’s Schedule of Values
b. Contractors Monthly Progress Payment Requests
c. Contractor Change Order Requests requested by the District.

3.3.0 District Prepared Logs

3.3.1 The District will prepare the following logs that will be distributed at the weekly progress meetings: Open Request for Information Log; Open Submittal and Re-Submittal Log; Open Field Instruction Log; Open Notice of Non-Compliance Log. No other versions of these logs will be distributed, or used during the weekly meetings, or posted with the meeting minutes. However, the Contractor can provide comments as described in Section 01312, Project Meetings.

END OF SECTION 01318
SECTION 01330
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED DOCUMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01140 – “Work Restrictions”
C. Section 01290 – “Payment Procedures”
D. Section 01310 – “Construction Scheduling”
E. Section 01318 – “Document Management System”
F. Section 01400 – “Quality Control Requirements”
G. Section 01770 – “Project Closeout Procedures”
H. Section 01780 – “Project Record Documents”
I. Section 01820 – “Demonstration and Training”
J. Divisions 2 through 33 sections for Submittal Procedures requirements for the work in these sections

1.3 SUMMARY
A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other Submittals.
B. If an electronic document management system such as EADOC LLC’s EADDOC web-based system to aid in the document control, management and communications between the District, Architect, and Contractor is used, the processes, formats and quantities required by that program shall take precedence. All other provisions which are not contradictory to use of the electronic document management system shall remain in effect.

1.4 DEFINITIONS
A. Action Submittals, as used herein are written and/or graphic information that requires Architect and/or District responsive action. Submittals may be rejected for not complying with requirements. Prepare and submit Action Submittals as required by individual Specification Sections.
B. Informational Submittals, as used herein are written and/or graphic information that does not require Architect responsive action. Submittals may be rejected for not complying with
requirements. Prepare and submit Informational Submittals as required by individual Specification Sections.

C. Manufactured, as used herein applies to standard units usually mass-produced, and “fabricated” means items specifically assembled or made out of selected materials to meet individual design requirements.

D. Submittal Descriptions. Submittals requirements are specified in the technical sections. Submittals are identified by description as follows:

1. Preconstruction Submittals, as used herein are submittals which are required following a Notice to Award and prior to commencing Work on Site. Examples include, but are not limited to:
   a. Initial CPM Schedule
   b. Submittal Log (listing submittal schedule, including shop drawings and samples)
   c. Initial Schedule of Values
   d. Safety Plan
   e. Waste Management Plan
   f. Quality Control Plan
   g. Others as required by the Contract Documents

2. Shop Drawings, as used herein are drawings, diagrams, schedules, and other data, which are prepared by Contractor, Subcontractors, manufacturers, fabricators, suppliers, or distributors illustrating some portion of the Work, and include: illustrations; fabrication, erection, layout and setting drawings; manufacturer’s standard drawings; schedules; descriptive literature, instructions, catalogs, and brochures; performance and test data including charts; wiring and control diagrams; and all other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and methods of construction as may be required to show that the materials, equipment, or systems and their position conform to the requirements of the Contract Documents.
   a. Shop drawings shall establish the actual detail of all manufactured or fabricated items, indicate proper relation to adjoining work, amplify design details of mechanical and electrical systems and equipment in proper relation to physical spaces in the structure, and incorporate minor changes of design or construction to suit actual conditions.

3. Product data, as used herein are catalog cuts, illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate a material, product, or system for some portion of the Work. This includes samples of warranty language when the contract requires extended product warranties.

4. Samples, as used herein are physical examples furnished by Contractor to illustrate materials, equipment, or quality and includes natural materials, fabricated items, equipment, devices, appliances, or parts thereof as called for in the Specifications, and any other samples as may be required by the Architect to determine whether the kind, quality, construction, finish, color, and other characteristics of the materials, etc., proposed by the
Contractor conform to the required characteristics of the various parts of the Work. All Work shall be in accordance with the approved samples.

5. Design Data, as used herein are design calculations, mix designs, analyses or other data pertaining to a part of Work.

6. Test Reports, as used herein, include:
   a. Reports signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)
   b. Reports which include findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.
   c. Reports which include findings of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.
   d. Investigation reports.
   e. Daily performance logs.
   f. Manufacturer or Installer checklists.
   g. Manufacturer's Factory or Field Reports, including documentation of the testing and verification actions taken by manufacturer at the factory or manufacturer's representative at the job site, in the vicinity of the job site, on or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.
   h. Final acceptance test and operational test procedure.

7. Manufacturer's Instructions. Preprinted material describing installation of a product, system or material, including special notices, checklists, and Material Safety Data sheets concerning impedances, hazards and safety precautions.

8. Operation and Maintenance Data. Data that is furnished by the manufacturer or the system provider to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by District operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item. This data is intended to be incorporated in the Operations and Maintenance manual submittals.

9. Closeout Submittals. Documentation to record compliance with technical or administrative requirements in order to meet all requirements necessary to properly close out the Construction Contract. These include, but are not limited to:
   a. Record Drawings
   b. As-built drawings
   c. Others as required by the Contract Documents.
1.5 PREPARATION AND FORMAT

A. Transmit each submittal, except sample installations and sample panels to the District. If the District, the Architect, and the Contractor mutually agree, submittals from the Contractor may be transmitted to the District and the Architect at the same time. However, following review by the Architect-Engineer team, submittals shall be transmitted back to the District Construction Manager prior to further distribution.

B. Transmit submittals with transmittal form prescribed by District and standard for the Project.
   1. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample[s].

C. Identifying Submittals. When submittals are provided by a Subcontractor, the Contractor shall prepare, review and stamp with Contractor's approval stamp all specified submittals prior to submitting for District approval. Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:
   1. District Project Number and title.
   2. Construction contract number.
   3. Date of the drawings and revisions.
   4. Product identification and location in project.
   5. Name, address, and telephone number of subcontractors, supplier, manufacturer and any other second tier Contractor associated with submittal.
   6. Section number of the specification section which requires the submittal.
   7. When a resubmission, add numeric revision suffix on submittal description, for example, submittal 18 would become 18R1, to indicate resubmission.

D. Format for Shop Drawings
   1. Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Prepare drawings that will be submitted to Division of State Architect (DSA) noted as Deferred Approval in the bid drawings and specifications as mandated by DSA.
   2. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.
   3. Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.
   4. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."
   5. Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the District Project name and number in the margin, immediately below the title block, for each drawing.
6. Reserve a blank space on the right-hand side of each sheet for the Architect’s disposition stamp.

7. Dimension drawings, except diagrams and schematic drawings and prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

8. Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

9. Where applicable, Submittals will be transmitted via the Document Management System specified in Section 01318

E. Format of Product Data and Manufacturer's Instructions

1. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

2. Indicate by prominent notation each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

3. Supplement product data with material prepared for Project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of Certificates.

4. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on all product data. Also include applicable industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, include such information in the submittal.

5. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.
   a. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the District Project Manager. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

6. Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of construction effort.

7. Submit manufacturer's instructions prior to installation.

F. Format of Samples

1. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:
a. Sample of Equipment or Device: Full size.
b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
d. Sample of Linear Devices or Materials: 10-inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
e. Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.
f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.
g. Sample Panel: 4 by 4 feet.
h. Sample Installation: 100 square feet.

2. Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

3. Reusable Samples: Incorporate returned samples into work only if so specified, indicated, or approved by Architect and District. Incorporated samples are to be in undamaged condition at time of use.

4. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean-up of project.

G. Format of Design Data and Certificates. Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

H. Format of Test Reports and Manufacturer's Field Reports
   1. Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.
   2. Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

I. Format of Operation and Maintenance Data shall comply with the requirements specified in Section 01785 Operation and Maintenance data for O&M Data format.

J. Format of Preconstruction Submittals and Closeout Submittals.
   1. When submittal includes a document, which is to be used in Project or become part of Project Record, other than as a submittal, do not apply Contractor’s approval stamp to document, but to a separate sheet accompanying document.
   2. Provide all dimensions in English units only.
1.6 QUANTITY OF SUBMITTALS

A. Where applicable, Submittals will be transmitted via the Document Management System specified in Section 01318; in which case, the digital copies will constitute fulfillment of the quantity. Otherwise,

B. Number of Copies of Shop Drawings. Submit in compliance with the following requirements:
   1. Submit three (3) original, wet-signed, and one (1) color PDF file for submittals that require shop drawings unless otherwise directed by District.
   2. Submittals that require local and State agency approval, shall conform with this Specification and the requirements of the local or State agency.

C. Contractor shall receive one hardcopy and one (1) reviewed electronic PDF file of the submittal. Contractor shall be responsible for providing copies to its subcontractors.

D. Number of Copies of Product Data and Manufacturer’s Instructions. Submit in compliance with quantity requirements specified for shop drawings.

E. Number of Samples
   1. Submit three (3) sets of samples showing range of variation, of each required item. Two approved samples or sets of samples will be retained by District and one will be returned to Contractor.
   2. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.
   3. When required by Contract Documents, provide one sample installation where directed by Architect or District.

F. Number of Copies Design Data and Certificates. Submit in compliance with quantity requirements specified for shop drawings.

G. Number of Copies Test Reports and Manufacturer’s Field Reports. Submit in compliance with quantity and quality requirements specified for shop drawings.

H. Number of Copies of Operation and Maintenance Data. Submit three (3) copies of O&M Data to the District Project Manager for review and approval.

I. Number of Copies of Preconstruction Submittals and Closeout Submittals. Unless otherwise specified, submit as required for shop drawings.

1.7 SUBMITTALS, GENERAL

A. Contractor shall obtain and shall submit all required shop drawings, samples, technical data, and other submittals as required by the Contract Documents with such promptness as to cause no delay in its own Work or in that of any other contractor or subcontractor.
   1. As required by the Contract Documents, the Contractor shall obtain and submit with shop drawings all seismic and other calculations, and all product data from equipment manufacturers.
   2. No shop drawing submittals shall be reviewed until coordinated documents per paragraph 1.13.C.1.b and c have been submitted, reviewed and signed off by representatives of each of the sub-contractors.
B. Prepare a complete Submittal Log and maintain it as the Work progresses. Submit the initial Submittal Log for approval by District at the same time as the Initial Schedule (See Section 01310 Construction Scheduling). Include the Contractor’s anticipated submission dates and the approval needed dates (if approval is required).

1. Re-submit submittal log and annotate monthly by the Contractor with actual submission and approval dates. When all items on the log have been fully approved, no further re-submittal is required.

2. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Log."

3. Except as specified otherwise, allow review period of at least fifteen (15) working days for submittals requiring Architect or District approval. Period of review for submittals requiring approval begins when District receives submittal from Contractor.

4. For submittals requiring review by fire protection engineer and/or DSA, allow review period, beginning when District receives submittal thirty (30) calendar days for return of submittal to the Contractor.

5. Period of review for each resubmittal is the same as for initial submittal.

C. The District may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections.

D. Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

E. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

F. No extensions of time will be granted to Contractor or any Subcontractor because of its failure to have shop drawings, samples, product data and/or other required submittals submitted in accordance with the approved Submittal Log and Master Construction Schedule.

G. Each Subcontractor shall submit all shop drawings, samples, product data and other required submittals for the review by the District and the Architect through the Contractor.

H. By submitting shop drawings, samples, product data and other required submittals, the Contractor represents that it has determined and verified all materials, field measurements, catalog numbers, related field construction criteria, and other relevant data in connection with each such submission, and that it has checked, verified, and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents, including the construction schedule.

I. Quality Control Certification. Stamp each sheet of each submittal with a quality control certifying statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only. When approving authority is Architect or District, Contractor shall certify submittals with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number [_______], is in compliance with the Contract Documents, does not constitute an unapproved
substitution, deviation, or variation, can be installed in the allocated spaces, and is submitted for District approval.

I further certify that I have reviewed and approved the field dimensions and the construction criteria and have also made written notation regarding any information in the shop drawings that does not fully conform to the Contract Documents. This submittal has been coordinated with all other submittals received to date, and this duty of coordination has not been delegated to subcontractors, material suppliers, the Architect, or the Engineers on this project.

For the Contractor:

Certified by Submittal Reviewer _____________________, Date ______
(Signature)

Certified by QC Manager _____________________________, Date ______
(Signature)

J. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review by either District or Architect. Mark each copy of each submittal to show which products and options are applicable.

K. The submission of the shop drawings, samples, product data and other required submittals, shall not deviate from the requirements of the Contract Documents including detailing and design intent which is specifically outlined in Contract Documents except as specifically authorized by the Architect or through an accepted substitution, per the requirements of the Contract Documents.

L. Deviations from the Contract Documents

1. Any deviations from the Contract Documents shall be fully described in a transmittal accompanying the shop drawings, samples, product data and other required submittals. However, such submittals shall not be used as a means of requesting a substitution, the procedure for which is defined elsewhere in the Contract Documents.

2. Architect and District approval is required for any proposed deviation from the accepted design which still complies with the Contract Documents before the Contractor is authorized to proceed with material acquisition or installation. If necessary to facilitate the project schedule, the Contractor and the Architect may discuss a submittal proposing a deviation with the District Project Manager prior to officially submitting it to the District. However, the District reserves the right to review the submittal before providing an opinion, if deemed necessary. In any case, the District will not formally agree to or provide a preliminary opinion on any deviation without either the Architect’s approval or recommended approval.

3. The District reserves the right to reject any deviation which may impact furniture, furnishings, equipment selections, and/or operations decisions that were made previously and based on the District reviewed and approved Project design.
4. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the District requiring rejection and removal of such work at the Contractor’s expense.

5. After submittals have been accepted by the Architect, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

M. Review by District and Architect shall not relieve the Contractor or any Subcontractor from its responsibility in preparing and submitting proper submittals in accordance with the Contract Documents.

N. Any submission, which in Architect’s opinion is incomplete, contains errors, or been superficially checked will be returned by the Architect without review for resubmission by the Contractor.

O. Electronic copies of the stamped and signed Contract Documents will not be provided by District or Architect for Contractor’s use unless:
   1. Contractor shall first request and obtain written approval from Architect prior to use of any Architect’s CAD files, drawings, or other documents for submittal purposes.
   2. Contractor shall be responsible for all reproduction, printing, and delivery cost associated with the use of any requested drawings and/or CAD files.
   3. Contractor provides disclaimer letters to the Architect and District (15) working days in advance of any proposed use of Architect’s documents and/or digital files. Such disclaimer letter shall be in a form acceptable to Architect and District.
   4. Contractor shall not reuse any Architect’s documents and/or electronic files for submittal purposes without prior written approval.

P. Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination. The Contractor shall ensure Mechanical, Electrical, and Plumbing (MEP) sub-contractors provide coordinated and comprehensive submittals for all integrated systems. Multiple submittal packages will not be allowed and will be returned without review or action. No extension of Contract Time will be authorized due to incomplete or uncoordinated Contractor submittals.
      a. Architect and District reserve the right to withhold action on, or return without review, a submittal requiring coordination with other submittals until all such related submittals are received. No extension of the Contract Time will be authorized.
      b. Architect and District will return incomplete submittals to the Contractor without review. No extension of Contract Time will be authorized due to incomplete Contractor submittals.

Q. Submittals Schedule: Comply with requirements in Section 01310 (Construction Scheduling) in planning for required submittals and relating them to scheduled construction activities.
1. Initial Review: Allow (15) working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will, through the Construction or Project Manager, advise Contractor when a submittal review must be delayed for coordination reasons.

2. Intermediate Review: If intermediate submittal review is necessary, process it in the same manner as an initial submittal.

3. Re-submittal Review: Allow (10) working days for review of each re-submittal.

4. Sequential Review: Where sequential review of submittals by Architect’s consultants, District, or other parties is indicated, allow (15) working days for initial review of each submittal.

5. DSA Deferred Approvals Review: see paragraph 1.13 C.18 for detailed procedures

R. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision(s).
   3. Cloud or otherwise highlight and call out **ALL** changes made in each re-submittal.
   4. Provide cover letter in each re-submittal, identifying all changes made in each re-submittal.
   5. Resubmit submittals until they are marked “No Exceptions Taken” or “Make Corrections Noted” by the Architect.

S. After submittals have been accepted by the Architect, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

**1.8 ARCHITECT’S REVIEW**

A. Architect’s review is for general conformance with design concept only and does not relieve Contractor in any way from compliance with Contract Documents, nor does it in any way constitute grounds for a Change Order. Contractor remains solely responsible for details and accuracy of all quantities and dimensions, and selection of fabrication and/or installation processes.

B. The Architect’s review shall neither be construed as a complete check which relieves the Contractor, Subcontractor, manufacturer, fabricator, or supplier from responsibility for any deficiency that may exist or from any departures or deviations from the requirements of the Contract Documents unless the Contractor has, in writing, called the Architect’s attention to the deviations at the time of submission.

C. The Architect’s review shall not relieve the Contractor or Subcontractors from responsibility for errors of any sort in any required submittals, for proper fitting of the Work, coordination of the differing subcontractor trades, and Work which is not indicated on any submittal at the time of submission.

D. In reviewing shop drawings, samples, product data and other required submittals, the Architect will not verify dimensions and field conditions.
E. The Architect will review and approve shop drawings, samples, product data and other required submittals for aesthetics and for conformance with the design concept of the Work and the Contract Documents.

F. Architect will review each submittal, make marks to indicate corrections or modifications required, and return it.

G. Contractor and Subcontractors shall be solely responsible for any quantities which may be shown on either the submittals or the Contract Documents.

H. Architect will not review submittals that do not bear Contractor’s approval stamp and Quality Control Certification Letter and will return them to the Contractor without review.

I. Architect will stamp each submittal appropriately to indicate action to be taken, as follows:
   1. No Exceptions Taken: Work covered by submittal may proceed provided it complies with the requirements of the Contract Documents. Compliance with Contract Documents is a condition of acceptance of the Work.
   2. Make Corrections Noted: Work covered by the submittal may proceed provided it complies with Architect and or Engineer notations and/or corrections. Contractor shall make all noted corrections. Compliance with Contract Documents is a condition of acceptance of the Work.
   3. Revise and Resubmit: Do not proceed with any Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise the submittal in accordance with Architect and/or Engineer notations and resubmit without delay. Repeat if necessary.
   4. Rejected. See Remarks: Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Prepare a new submittal in accordance with Architect/Engineer’s notations and resubmit without delay.

J. Use of Submittals for Construction: Use only final submittals with Architect’s mark indicating “No Exceptions Taken” or “Make Corrections Noted.”

K. Informational Submittals: Architect will review each submittal but will not return it or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

1.9 REJECTED SUBMITTALS

A. Contractor shall make corrections required by the Architect and resubmit.

B. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, he shall provide notice to the Architect and District.

C. If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.10 NO EXCEPTIONS TAKEN OR MAKE CORRECTIONS NOTED SUBMITTALS

A. Acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor is responsible for the satisfactory construction of all work.
1.11 NO EXCEPTIONS TAKEN OR MAKE CORRECTIONS NOTED SAMPLES

A. Acceptance of a sample is only for the characteristics or use named in such acceptance and is not be construed to change or modify any contract requirements. Before submitting samples, the Contractor shall assure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been accepted.

B. Match the accepted samples for Materials and equipment incorporated in the work. If requested, accepted samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not accepted will also be returned to the Contractor at its expense, if so requested. Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. District reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

C. Samples of various materials or equipment delivered on the site or in place may be taken by the District Construction Manager or Project Manager for testing. Samples failing to meet contract requirements will automatically void previous acceptance, and Contractor shall replace such materials or equipment at Contractor expense to meet contract requirements.

D. Acceptance of the Contractor's samples by the AOR or District does not relieve the Contractor of his responsibilities under the contract.

1.12 WITHHOLDING OF PAYMENT

A. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

B. No payment for materials incorporated in the work will be made if all required Designer of Record or required District approvals have not been obtained.

C. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

1.13 SUBMITTAL REQUIREMENTS

A. Shop Drawings

1. Transmittal Letter and Other Requirements. All shop drawings must be properly identified with the name of the Project and dated, and each lot submitted must be accompanied by a letter of transmittal referring to the name of the Project and to the Specification section number for identification of each item clearly stating in narrative form, as well as “clouding” on the submissions, all qualifications, departures, or deviations from the Contract Documents. Shop drawings, for each section of the Work shall be numbered consecutively and the numbering system shall be retained throughout all revisions. All Subcontractor submissions shall be made through the Contractor. Each drawing shall have a clear space for the stamps of Architect and Contractor.

2. Copies Required. Each submittal shall include one (1) original drawing, one (1) PDF format digital file, and five (5) legible prints of each drawing or schedule, table, cut sheet, etc., including fabrication, erection, layout and setting drawings, and such other drawings as
required under the various sections of the Specifications, until final acceptance thereof is obtained. Subcontractor shall submit copies, in an amount as requested by the Contractor, of: (1) manufacturers’ descriptive data for materials, equipment, and fixtures, including catalog sheets showing dimensions, performance, characteristics, and capacities; (2) wiring diagrams and controls; (3) schedules; (4) all seismic calculations and other calculations; and (5) other pertinent information as required by the District or Architect.

3. Corrections. The Contractor shall make all corrections required by Architect and shall resubmit, as required by Architect, corrected copies and digital files of shop drawings or new samples until approved. Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections required by the Architect on previous submissions. Professional services required for more than one (1) re-review of required submittals of shop drawings, product data, or samples are subject to charge to the Contractor by the District.

4. Approval Prior to Commencement of Work. No portion of the Work requiring a shop drawing or sample submission, or other submittal shall be commenced until the submission has been reviewed by Contractor and Architect and approved by Architect unless specifically directed in writing by the Architect. All such portions of the Work shall be in accordance with approved shop drawings and samples.

5. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed detail.

6. Fully illustrate requirements of the Contract Documents. Include the following information, as applicable:
   a. Dimensions
   b. Weights and measures
   c. Identification of products
   d. Fabrication and installation drawings
   e. Roughing-in and setting diagrams
   f. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring
   g. Electrical power requirements
   h. Shop work manufacturing instructions
   i. Templates and patterns
   j. Schedules
   k. Design calculations
   l. Compliance with specified standards
   m. Notation of coordination requirements
   n. Notation of dimensions established by field measurement
   o. Relationship to adjoining construction clearly indicated
   p. Seal and signature of California professional engineer or other engineer if specified
q. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring

r. Other information as necessary or required by the Contract Documents

B. Samples

1. Samples Required. In case a considerable range of color, graining, texture, or other characteristics are anticipated in finished products, a sufficient number of samples of the specified materials shall be furnished by the Contractor to indicate the full range of characteristics which will be present in the finished products; and products delivered or erected without submittal and approval of a full range of samples shall be subject to rejection by the District.
   a. Except for range samples, and unless otherwise called for in the various sections of the Specifications, samples shall be submitted in duplicate.
   b. All samples shall be marked, tagged, or otherwise properly identified with the name of the submitting party, the name of the Project, the purpose for which the samples are submitted and the date, and shall be accompanied by a letter of transmittal containing similar information, together with the Specification section number. Each tag or sticker shall have clear space for the review stamps of Contractor and Architect.

2. Labels and Instructions. All samples of materials shall be supplied with the manufacturer’s descriptive labels and application instructions.

3. Architect’s Review. The Architect will review and, if appropriate, approve submissions and will return them to the Contractor with the Architect’s stamp and signature applied thereto, indicating the timing for review and appropriate action in compliance with the Contract Documents.

4. Identification: Attach label on unexposed side of Samples that includes the following information:
   a. Generic description of Sample
   b. Product name and name of manufacturer
   c. Sample source
   d. Number and title of appropriate Specification Section
   e. District Project name and number
   f. Contractor’s name
   g. Date of submittal

5. Disposition: Maintain sets of all approved Samples at Project site, available for quality-control comparisons throughout the course of the Project. Sample sets may be used to determine final acceptance of construction associated with each sample or sample set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, if any, or otherwise designated as District’s property, are the property of Contractor.
6. **Samples for Initial Selection:** Submit manufacturer’s color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. **Number of Samples:** Submit 6 full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer’s product line.

7. **Samples for Verification:** Where required by the Contract Documents, submit full-size units of Samples, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. **Number of Samples:** Unless indicated otherwise, submit six sets of Samples. Architect will retain two Sample sets; remaining four sets will be returned.
      i) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      ii) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by Sample, submit at least four sets of paired units that show approximate limits of variations.

8. **District’s Property.** All shop drawings, computer disks, annotated specifications, samples, and other submittals shall become the District’s property upon receipt by the District or Architect.

C. **Other Submittals**

1. **General:** Prepare and submit Submittals required by other Specification Sections.
   a. **Test and Inspection Reports:** Comply with requirements specified in Section 01400 Quality Control Requirements.
   b. **Coordination Drawings:** Comply with requirements specified in Section 01311 Project Management and Coordination.
      i) Coordination Drawings are required where limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
      ii) Contractor shall not start any portion of the Work without approval of coordination submittals from the Architect.
   c. **Coordination Documents (Mechanical, Electrical, and Plumbing)**
      i) Contractor is required to submit Coordinated Mechanical, Electrical, Plumbing Layout Drawings to coordinate installation and location of HVAC ductwork, grilles, diffusers, hydronic piping, fire sprinklers, plumbing, light fixtures and electrical services (including, but not limited to floor boxes, conduits, cable trays, low voltage systems, fire alarm, etc.).
ii) Coordinated MEP Layout Drawings are to be composite ¼” equals 1-foot scale drawings that show all services color-coded on a single sheet. Drawings are to be coordinated with structural framing systems and architectural systems (roofing, ceilings, finishes). Section drawings, with detailed elevations above finished floor for ducts, piping, fixtures, etc. are to be included to identify and avoid conflicts.

iii) Coordination Documents shall be submitted for review by Architect and engineers prior to submittal of MEP shop drawings.

iv) Shop drawings for the systems noted in 1.07.A.2 will not be reviewed before the MEP Coordination Documents are signed off by representatives of each of the Mechanical and Electrical sub-contractors as well as the Contractor.

v) Contractor to hold coordination meetings to complete these Coordination Documents, attended by all Mechanical, Electrical, and Plumbing sub-contractors whose work scope is represented in the Coordination Documents. These meetings shall be scheduled in the CPM Schedule.

vi) No fabrication work or field installation shall commence before the Coordination Documents are signed off by representatives of each of the Mechanical, Electrical, and Plumbing sub-contractors.

vii) See Mechanical, Electrical, and Plumbing Specification Sections for additional requirements.

2. Product Data: Submit manufacturer’s printed literature in original form as required in the Contract Documents. Submittal shall include specifications, physical dimensions, and ratings of all equipment. Furnish performance curves for all fans and pumps. Where printed literature describes items in addition to that item being submitted, submitted item shall be clearly marked on submittal and superfluous information shall be crossed out in the same manner on all copies. Equipment submittals shall be complete and include space requirements, weight, electrical and mechanical requirements, performance data, and any supplemental information that may be available or requested.

3. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.


5. Installer Certificates: Prepare written statements on manufacturer’s letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

6. Manufacturer Certificates: Prepare written statements on manufacturer’s letterhead certifying that product complies with requirements in the Contract Documents.

7. Material Certificates: Prepare written statements on manufacturer’s letterhead certifying that material complies with requirements in the Contract Documents.
8. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency’s standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

9. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

10. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   a. Name of evaluation organization
   b. Date of evaluation
   c. Time period when report is in effect
   d. Product and manufacturer’s names
   e. Description of product
   f. Test procedures and results
   g. Limitations of use

11. Schedule of Tests and Inspections: Comply with requirements specified in Section 01400 Quality Control Requirements.

12. Preconstruction Test Reports: Prepare test reports written by a qualified testing agency, on testing agency’s standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

13. Compatibility Test Reports: Prepare test reports written by a qualified testing agency, on testing agency’s standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

14. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency’s standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

15. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Section 01785 (Operation and Maintenance Data.)

16. Manufacturer’s Installation and Operations Instructions: Prepare written or published information that documents manufacturer’s recommendations, guidelines, and procedures for installing or operating a product or equipment. Manufacturer’s Instructions shall be available for review on site at all times. Include name of product and name, address, and telephone number of manufacturers. Include the following, as applicable:
   a. Preparation of substrates
   b. Required substrate tolerances
c. Sequence of installation or erection

d. Required installation tolerances

e. Required adjustments

f. Recommendations for cleaning and protection

17. Manufacturer’s Field Reports: Prepare written information documenting factory-authorized service representative’s tests and inspections. Include the following, as applicable:

a. Name, address, and telephone number of factory-authorized service representative making report.

b. Statement on condition of substrates and their acceptability for installation of product.

c. Statement that products at Project site comply with requirements.

d. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

e. Results of operational and other tests and a statement of whether observed performance complies with requirements.

f. Statement whether conditions, products, and installation will affect warranty.

g. Other required items indicated in individual Specification Sections.

18. DEFERRED APPROVALS

a. Submit detailed plans, specifications and engineering calculations for all deferred approval items.

b. Calculations and drawings of structural nature shall be prepared and signed by a Structural Engineer registered in the State of California.

c. Submit 6 complete sets. If revisions are necessary, the Architect will return one copy to the Contractor. Resubmit 6 complete sets with all corrections. Three sets will be sent to D.S.A. for review.

d. If revisions are required by D.S.A., make the corrections and submit 6 complete sets with all corrections, along with D.S.A. check set, to the Architect. After D.S.A. approval, one D.S.A. approved set will be returned to the Contractor.

e. Contractor shall distribute DSA approved documents to CM, PM, IOR and other designated sub-contractors

f. Fabrication and installation of deferred approval items shall not be started until detailed plans, specifications and engineering calculations have been accepted by the Architect and the Division of the State Architect.

PART 2 - PRODUCTS: Not Used.

PART 3 - EXECUTION: Not used

END OF SECTION 01330
SECTION 01340
ADMINISTRATIVE FORMS & LOGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01015 – “Project Phasing”
B. Section 01290 – “Payment Procedures”
C. Section 01310 – “Construction Scheduling”
D. Section 01311 – “Project Management and Coordination”
E. Section 01330 – “Submittal Procedures”
F. Section 01625 - “Product Options and Substitutions”
G. Section 01780 – “Project Record Documents”
H. Divisions 2 through 33 Sections for Administrative Forms & Logs requirements for the Work in those Sections.

1.3 SUMMARY

A. This section specifies the information and format requirements for administrative forms and logs.

1.4 ADMINISTRATIVE FORMS & LOGS

A. Administrative forms and logs include, but are not limited to, the following:
   1. Transmittal Form
   2. Submittal Transmittal Form
   3. Request for Information Form.
   4. Substitution Request Form.
   5. 3-Week Projected Construction Schedule Form
   6. 3-Week Testing & Inspection Schedule Form
   7. Proposed Change Order Form.
   8. Change Order Form.
   9. Request for Information Log Form.
  10. Submittal Log Form
11. Proposed Change Order Log Form.
12. Change Order Log Form.
13. Contractor’s Proposal for Contract Modification Form* (includes sample numbers to demonstrate calculations only)
14. Contractor Production Report

B. Forms generated by project management software may be substituted if substitution forms contain essentially the same information as shown in these Contract Documents. Allowance for the use of substitute forms is at the sole discretion of the District, and shall be requested and approved before use of the substitute form. Forms marked with an asterisk (*) may NOT be substituted under any condition.

C. Microsoft Excel files of these forms are available for Contractor use from the District.

1.5 FORMS INCORPORATED BY REFERENCE

A. Forms available from the California Department of General Services, Division of the State Architect, http://www.dgs.ca.gov/dsa/Forms.aspx, related to administration, construction, testing, and inspection of public work school facilities are hereby incorporated by reference into these Contract Documents.

1.6 CONTRACTOR RESPONSIBILITIES

A. Nothing in this Section 01340 including, but not limited to the above forms and log forms shall be construed to limit, relieve, or release Contractor from liability to District for any damages sustained as a result of inaccurate or incorrect information supplied by the Contractor.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.
CONTRA COSTA COMMUNITY COLLEGE DISTRICT
500 Court Street, Martinez, CA 94553-1203
Phone: (925) 228-1000
Fax: (925) 335-9697

TRANSMITTAL TO:

Date: ___________________

From: ___________________

Via: ___________________

Fax
US Mail
Hand Delivery
US Mail
Pick-Up
Overnight Mail
Email

Contract No.: ____________ Project No. and Name: ______________

Shop Drawings
Copy of Letter
O&M Manual
Submittals
Change Order
Project Closeout Documents
Plans
Samples
Warranty Documents
Specifications
Product Data
Disks
Other: _____________

Copies
Date
Number
Description

For Your Info
For Your Approval
As Requested
For Your Review and Comment
Originals for Signatures
As Required per Contract Para:
Other

Remarks:

Copy To: ___________________
From: ___________________

Print Name
Signature: ___________________

Print Name
Signature: ___________________
Date: __________

Received by: ____________________________

Print Name
Signature: __________________

Page 1 of 1
## Request for Information (RFI)

### Contractor Name: ___________________________  Date: ___________________________

**Contractor Name:**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Request</th>
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### DSA File #: ___________________________

<table>
<thead>
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<th>Drawing Number/Detail Number</th>
<th>Specification Section</th>
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### Project No., Name: ___________________________

### Reference:

**Campus:** ___________________________

**Project No., Name:** ___________________________

### Suggestion:

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### Request Issued By:

- **Contractor’s Signature:** ___________________________  **Name (Printed):** ___________________________  **Date:** ___________________________

### Response Issued By:

- **Architect/Engineer Signature:** ___________________________  **Name (Printed):** ___________________________  **Date:** ___________________________

### Response Reviewed By:

- **Owner Authorized Representative (Project Manager):** ___________________________  **Name (Printed):** ___________________________  **Date:** ___________________________

### Note to Contractor:

- This Form Cannot Modify Contract Amount or Milestones and/or Contract Time.

---

**Contra Costa Community College District**

500 Court Street, Martinez, CA 94553

**Diablo Valley College**

D-4002 SRC Increment 2 – Expansion & Renovation
**CONTRA COSTA COMMUNITY COLLEGE DISTRICT**

500 Court Street, Martinez, CA 94553

**SUBSTITUTION REQUEST FORM**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>SPECIFIED/ITEM OR DRAWING</th>
<th>SPECIFICATION SECTION</th>
<th>PROPOSED SUBSTITUTION (and name of Subcontractor if different)</th>
</tr>
</thead>
</table>

**CERTIFICATION**

Under penalty of perjury under the laws of California, I certify that the proposed substitution will be readily available, perform adequately the functions and achieve the results called for by the design concept, be similar in substance to the specified, and be subject to the same use as that specified in Contract Documents.

Contractor: 

(please print name of company) Name and Title (printtype) Contractor Authorized Representative Date

A. Does the substitution affect dimensions shown on Drawings?

B. Will the undersigned pay for any changes to the building design, including engineering and detailing costs caused by the requested substitution?

C. What effect does the substitution have on other trades?

D. Will substitution cause change to Project Schedule, or to critical delivery dates? Add? Shorten?

E. Differences between proposed substitution and specified item?

F. What is the Cost Differential including all mark-ups?

G. Are Manufacturer\'s guarantees for the proposed item the same as for item specified? Explain differences.

H. The undersigned accepts full responsibility for delays caused by redesign of other items of the Work necessitated by substitution.

I. The undersigned states that the function, appearance and quality are equivalent or superior to the specified item.

**A/E Response:** District Representative Response:

- [ ] Accepted
- [ ] Not Accepted
- [ ] Accepted As Noted
- [ ] Received Too Late

**By:** Date: **By:** Date:

K:\Project Filing System\CCC\07-17-College Center (assign)\Design Dev\05 Const Docs Phase 03\5-6 Spec & Pro-01 CCC-DIVISION 0 & 1 DRAFT\00 0 & 1 working templates\Forms 1 Logos Template\Substitution Request Form - SWF.xls
<table>
<thead>
<tr>
<th>Item</th>
<th>Task</th>
<th>Required IOR Inspection YES or NO</th>
<th>Reqd Testing Lab. Ins. Ins. Y/N</th>
<th>Week 1</th>
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Project Phase #: ____________

Remarks:

Submitted by: ____________

Print Name: ____________

Sign & Date: ____________
CONTRA COSTA COMMUNITY COLLEGE DISTRICT
500 Court Street, Martinez, CA 94553

PROPOSED CHANGE ORDER
PCO No.: ______________________

<table>
<thead>
<tr>
<th>Contractor Name:</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Contract #:</td>
<td>DSA File #: 7-C1</td>
</tr>
<tr>
<td>Contract Date:</td>
<td>DSA Application #:</td>
</tr>
<tr>
<td>NTP Date:</td>
<td>Campus:</td>
</tr>
<tr>
<td>GL #:</td>
<td>Project No., Name:</td>
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PRELIMINARY CHANGE AS FOLLOWS:
Within (7) days provide and submit to the Project Manager a complete and itemized proposal including but not limited to the following items: cost breakdown of Labor, Materials, Equipment, Markup, Construction Schedule, etc. Provide either ADD or DEDUCT to the original Contract Amount.

<table>
<thead>
<tr>
<th>Scope of Work:</th>
<th>Ref. (Drawings, Specifications, Others):</th>
</tr>
</thead>
</table>

Final Cost of this PCO $0.00
The Contractor requests that time will be Increased: Decreased: By ______ Working Days

NOTE: The Contractor waives any claim for further adjustments of the Contract Sum and Contract Time related to the changes in work as described above.

<table>
<thead>
<tr>
<th>1 - REVIEWED &amp; RECOMMENDED (Architect/Engineer of Record)</th>
<th>5 - CONTRACTOR ACCEPTANCE</th>
</tr>
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<tbody>
<tr>
<td>Company Name:</td>
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<td>Address:</td>
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<tr>
<th>2 - CONSTRUCTION MANAGER (CM) - (when applicable)</th>
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<td>Signature / Date</td>
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<th>3 - PROJECT INSPECTOR (PI) - (when applicable)</th>
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<td>Signature / Date</td>
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<th>4 - PROJECT MANAGER (PM)</th>
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<th>6 - DISTRICT REPRESENTATIVE</th>
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<tbody>
<tr>
<td>DSA APPROVAL (when applicable)</td>
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10/09/2021
12:00 PM
1-21-21

[Signature]
Contra Costa Community College District
Diablo Valley College
D-4002 SRC Increment 2 – Expansion & Renovation
CONTRA COSTA COMMUNITY COLLEGE DISTRICT
500 Court Street, Martinez, CA 94553

CHANGE ORDER No.: __________

Date: __________
DSA File #: D-4002 SRC Increment 2 – Expansion & Renovation

Contractor Name: __________
Contract #: __________
Contract Date: __________
NTP Date: __________
GL #: __________

THE CONTRACT IS CHANGED AS FOLLOWS: (Attach Contractor Change Order Request or Proposal - If applicable)

<table>
<thead>
<tr>
<th>ADJUSTMENT TO CONTRACT AMOUNT / TIME</th>
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<tbody>
<tr>
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<tr>
<td>Prior Contract Adjustments</td>
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<tr>
<td>Contract Sum Prior to this Change Order</td>
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<tr>
<td>Adjustment Per This Change Order</td>
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<tr>
<td>Revised Contract Amount</td>
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</table>

Original Contract Period: __________
Start Date: __________
End Date: __________
The Contract Time will be Increased; Decreased; By __________ Calendar Days

Revised Contract Completion Date: __________

NOTE: The Contractor waives any claim for further adjustments of the Contract Sum and Contract Time related to the above changes in Work.

1 - REVIEWED & RECOMMENDED (Architect/Engineer of Record)

5 - CONTRACTOR ACCEPTANCE

Company Name: __________
Address: __________
Stamp (when applicable) __________
Signature/Date __________

2 - CONSTRUCTION MANAGER (CM) - (when applicable)

Signature / Date __________

PROJECT INSPECTOR (PI) - (when applicable)

Signature / Date __________

4 - PROJECT MANAGER (PM)

C.O. NOT VALID WITHOUT Signature / Date __________

DSA APPROVAL (when applicable) __________

Page 1 of 1
## Request For Information Log - RFI LOG

<table>
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<tr>
<th>RFI No.:</th>
<th>Requested By:</th>
<th>Description</th>
<th>Date Submitted to AIS for Review</th>
<th>Date Returned to Contractor</th>
<th>RFI returned with AIS or POO (when applicable)</th>
<th>RFI Reviewed and Responded to: AIS</th>
<th>Date Submitted to POO</th>
<th>Date Returned to Contractor</th>
<th>Date Submitted to AIS</th>
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<th>Remarks</th>
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### Contra Costa Community College District

500 Court Street, Martinez, CA 94553

#### Submittal Log

<table>
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**DSA File #:**

**DSA Application #:**

**Campus:**

**Project No. and Name:**

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<th>Item No.</th>
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<th>Request Return Date (per architect)</th>
<th>Date Returned to Contractor</th>
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<th>A&amp;E Review Comments</th>
<th>Date Submitted to DSA</th>
<th>Date Returned from DSA</th>
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<th>Remarks</th>
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#### Project Submittal Analysis

- Number of submittal: No Exception Taken (NET)
- Number of Submittal: Make Correction Noted (MCN)
- Number of Submittal: Revised and Resubmit (R&R)
- Number of Submittal: Submit Specified Item (SSI)
- Number of Submittal: Rejected (R)
- Number of Open Deferred Approval Submittal
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<tr>
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<th>Original Contract Completion Date</th>
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CONTRA COSTA COMMUNITY COLLEGE DISTRICT
500 Court Street, Martinez, CA 94553

Date:

Project Re-inspection Record
By: Project Inspector

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<tr>
<td>Tue.</td>
<td></td>
<td></td>
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<tr>
<td>Wed.</td>
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<td>Thu.</td>
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List of Re-inspection by IOR (if applicable)

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</table>

Signature  Date
Inspector of Record

Print name:

Signature  Date
Project Manager

Print name:

1 DRAFT/REV 0 and 1 working template/Forms & Logs Templates/Project Inspector Re-inspection Form.xls
## CONTRACTOR'S PROPOSAL FOR CONTRACT MODIFICATION

**DATE:**

### Project No. and Name:  
D-4002 DVC San Ramon Campus Renovation and Expansion

### Contractor:

- **PCO NO.:**  
- **CONTRACT NO.:** 0

### SHORT DESCRIPTION OF CHANGE:

- Description attached

### PRIME CONTRACTOR'S WORK

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Line 1</th>
<th>Line 2</th>
<th>Line 3</th>
<th>Line 4</th>
<th>Line 5</th>
<th>Line 6</th>
<th>Line 7</th>
<th>Line 8</th>
<th>Line 9</th>
<th>Line 10</th>
<th>Line 11</th>
<th>Line 12</th>
<th>Line 13</th>
<th>Line 14</th>
<th>Line 15</th>
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<tr>
<td>2. Sales Tax on Materials</td>
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<td>8.75%</td>
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<td>3. Direct Labor</td>
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</tr>
<tr>
<td>4. Insurance, &amp; Taxes</td>
<td>19.13%</td>
<td>19.13%</td>
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<tr>
<td>5. SUBTOTAL Materials and Labor (Add lines 1-4)</td>
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<td>6. Rental Equipment</td>
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<tr>
<td>7. Sales Tax on Rental Equipment</td>
<td>8.75%</td>
<td>8.75%</td>
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<td>8. Equipment Ownership and Operating Expenses</td>
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<td>9. SUBTOTAL Equipment (Add Lines 5-8)</td>
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**SUMMARY**

<table>
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<tr>
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<th>Line 11</th>
<th>Line 12</th>
<th>Line 13</th>
<th>Line 14</th>
<th>Line 15</th>
<th>Line 16</th>
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<tbody>
<tr>
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<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
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<td>$0.00</td>
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</tbody>
</table>

### Estimated time extension and justification:

- **Work Days:** 0

### Prime Contractor’s Comments:

### Signature and Title of Preparer:

<table>
<thead>
<tr>
<th>Signature and Title of Preparer:</th>
<th>Date:</th>
</tr>
</thead>
</table>

1. Material (attach itemized quantity and unit cost plus sales tax)
2. Labor (attach itemized hours and rates)
3. Insurance, Taxes, and Fringe Benefits (See 0700 Article 7.7.3 (f) for breakdown)
4. Equipment (attach invoice)
5. Prime Contractor’s Bond Premium (See 0700 Article 7.7.3 (j) for breakdown)
6. If Subcontractor performed Work, use Subcontractor’s sheets to calculate costs. Subcontractor overhead and profit (all tiers cumulative) not to exceed fifteen percent (15%) of direct material, labor, and equipment on Subcontractor Summary sheets.
7. No more than five percent (5%) of item 13 if work was performed by Subcontractor.
8. (v. 3/2014)
### CONTRACTOR'S PROPOSAL FOR CONTRACT MODIFICATION

**Date:**

**Project No. and Name:** D-4002 DVC San Ramon Campus Renovation and Expansion

**Tier 1 Subcontractor:**

**SHORT DESCRIPTION OF CHANGE:**

<table>
<thead>
<tr>
<th>Description</th>
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**TIER 1 SUBCONTRACTOR'S WORK**

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<th>% of Line 1</th>
<th>% of Line 2</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
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<td>8.75%</td>
<td></td>
<td>$0.00</td>
</tr>
<tr>
<td>3. Direct Labor</td>
<td></td>
<td></td>
<td>$0.00</td>
</tr>
<tr>
<td>4. Insurance, &amp; Taxes</td>
<td>19.19%</td>
<td></td>
<td>$0.00</td>
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<tr>
<td>5. SUBTOTAL Materials and Labor (Add lines 1-4)</td>
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<td>6. Rental Equipment</td>
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</tr>
<tr>
<td>7. Sales Tax on Rental Equipment</td>
<td>8.75%</td>
<td></td>
<td>$0.00</td>
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<tr>
<td>8. Equipment Ownership and Operating Expenses</td>
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<tr>
<td>9. SUBTOTAL Equipment (Add Lines 6-8)</td>
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**SUMMARY**

<table>
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<tr>
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<th>Cost</th>
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<td>1. Direct Materials</td>
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**10. TIER 1 Contractor's Work (Add Lines 5 and 9)**

<table>
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**11. Not used.**

**12. Not used.**

**13. Not used.**

**14. Not used.**

**15. SUBTOTAL (Add Lines 10-14)**

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**16. Not used.**

**17. TOTAL COST (Add Lines 15-16)**

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**Subcontractor's Comments**

**Subcontractor's Name:**

**Signature and Title of Preparer:**

(1) Material (attach itemized quantity and unit cost plus sales tax)

(3) Labor (attach itemized hours and rates)

(4) Insurance, Taxes, and Fringe Benefits (See 0700 Article 7.7.3 if for breakdown)

(6, 8) Equipment (attach invoices)
CONTRACTOR'S PROPOSAL FOR CONTRACT MODIFICATION

<table>
<thead>
<tr>
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<th>D-4002 DVC San Ramon Campus Renovation and Expansion</th>
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<td>Short Description of Change:</td>
<td>Description attached</td>
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<table>
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<td>1. Direct Materials</td>
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<tr>
<td>3. Direct Labor</td>
</tr>
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<td>4. Insurance, &amp; Taxes</td>
</tr>
<tr>
<td>5. SUBTOTAL Materials and Labor (Add lines 1-4)</td>
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<tr>
<td>6. Rental Equipment</td>
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<tr>
<td>7. Sales Tax on Rental Equipment</td>
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<td>10. Tier 2 Contractor's Work (Add Lines 5 and 9)</td>
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<td>12. Not used.</td>
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<td>16. Not used.</td>
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<td>17. TOTAL COST (Add Lines 15-16)</td>
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Tier 2 Subcontractor's Comments:

Tier 2 Subcontractor Preparer's Name:

Signature and Title of Preparer: Date:

1. Material (attach itemized quantity and unit cost plus sales tax)
2. Labor (attach itemized hours and rates)
3. Insurance, Taxes, and Fringe Benefits (See 0700 Article 7.7.3 (f) for breakdown)
4. Equipment (attach invoices)
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<th>Unit Quantity</th>
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<td>2</td>
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**Notes:**
- All materials must be approved by the District's Materials and Equipment Department.
- Labor rates are subject to change based on current labor market conditions.
- Equipment must be delivered within 10 business days of the start date.

**Removal of Direct Costs**

- Direct costs are to be removed from the final bid and invoiced separately.
- Costs for removal must be included in the final bid submission.

**Contra Costa Community College District**

**Diablo Valley College**

**D-4002 SRC Increment 2 – Expansion & Renovation**

**Administrative Forms & Logs**
### CONTRACTOR'S PROPOSAL FOR CONTRACT MODIFICATION

<table>
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<th>CONTRACT NO.:</th>
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**SHORT DESCRIPTION OF CHANGE:** Description attached

#### TIER 3 SUBCONTRACTOR’S WORK

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<tr>
<td>4. Insurance, &amp; Taxes</td>
<td>19.19%</td>
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<td>5. SUBTOTAL Materials and Labor (Add lines 1-4)</td>
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<td>6. Rental Equipment</td>
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<td>8. Equipment Ownership and Operating Expenses</td>
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<tr>
<td>9. SUBTOTAL Equipment (Add Lines 6-8)</td>
<td></td>
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<tr>
<td><strong>SUMMARY</strong></td>
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<td>12. Not used.</td>
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<td>14. Not used.</td>
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<td>15. SUBTOTAL (Add Lines 10-14)</td>
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<td>16. Not used.</td>
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<tr>
<td>17. TOTAL COST (Add Lines 15-16)</td>
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<td>$0.00</td>
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#### Tier 3 Subcontractor’s Comments

- [ ] Signature and Title of Preparer:
  - Date:

(1) Material (attach itemized quantity and unit cost plus sales tax)
(3) Labor (attach itemized hours and rates)
(4) Insurance, Taxes, and Fringe Benefits (See 0700 Article 7.7.3(f) for breakdown)
(6, 8) Equipment (attach invoices)
SECTION 01400
QUALITY CONTROL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01311 – “Project Management and Coordination”
C. Section 01330 – “Submittal Procedures”
D. Section 01410 – “Regulatory Requirements”
E. Section 01411 – “Testing Laboratory Services”
F. Section 01412 – “Regulatory Requirements – Hazardous Material”
G. Divisions 2 through 33 Sections for Quality Control Requirements for the work in those sections.

1.3 SUMMARY
A. This Section includes Administrative and Procedural Requirements for Quality Control and Quality Assurance Services includes, but not limited to, the followings:
   1. Quality assurance and control of installation.
   2. References.
   3. Mock-ups
   4. Inspection and testing laboratory services
   5. Manufacturers’ field services and reports
   6. Field sample
   7. DSA Project Inspector
   8. Inspection by the Division of the State Architect
   9. Conflicts

1.4 QUALITY ASSURANCE/CONTROL OF INSTALLATION
A. Monitor quality control over suppliers, manufacturers, products, services, site conditions and workmanship, to produce Work of specified quality.
B. Comply fully with manufacturer’s written instructions, including each step in sequence.
C. When manufacturers' instructions conflict with Contract Documents, request clarification from District’s Representative before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. All Work shall be performed by persons qualified to produce workmanship of specified quality.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

G. Contractor’s Line of Authority: Contractor shall provide one person who shall be both knowledgeable and responsible for all work to be performed on the Project at all times during normal work hours. In Contractor’s absence, Contractor’s appointed representative shall be responsible for all directions given and said directions shall be binding as if given to the Contractor. Contractor’s representative shall be responsible to coordinate all work to be performed on the Project.

H. Shop and field work shall be performed only by mechanics skilled and experienced in the fabrication and installation of the work involved. All work on this Project shall be performed in accordance with the best practices of the various trades involved and in accordance with the Contract Documents, approved shop drawings and these specifications.

I. All work shall be erected and installed plumb, level, square and true and in proper alignment and relationship to the work of other trades. All finished work shall be free from defects. The District’s Representatives reserve the right to reject any materials and workmanship that are not considered to be of the highest standards of the trades involved. Any such inferior material or workmanship shall be removed and replaced at no additional cost or time impact to the District.

J. The specifications and recommendations of the manufacturer whose materials are used shall be strictly adhered to during the application or installation of materials. Manufacturer’s specifications, installation instructions, and testing and startup directions shall be available for inspection on Site.

K. Any additional work beyond that specified or illustrated in the Contract Documents, or any modification thereto, that is necessary to obtain the guarantees specified in the Contract Documents shall be provided by the Contractor without any additional cost or time impact to the District.

1.5 REFERENCES
A. Conform to reference standards in force on the most recent date of issue of the approved Contract Documents.

B. When specified reference standards conflict with Contract Documents, request clarification from District’s Representative before proceeding.

C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

D. The Contractor shall be responsible for being current and knowledgeable for all building codes involved for all trades under the Contractor’s direction.
E. Provide all work and materials in full in accordance with the latest applicable Rules and Regulations of the California Code of Regulations Title 24 Building Code Standards, the State Fire Marshal, Safety Orders of the Division of Industrial Safety, and any other applicable laws or regulations. Nothing in these plans or specifications is to be construed to permit Work not conforming to these Codes.

F. American Society for Testing and Materials (ASTM):

   1. 29 CFR 1910, Subpart A, Section 1910.7: Definitions and Requirements for a National Recognized Testing Laboratory.

H. NIST: National Institute of Standards and Technology.

I. Furnish all material and labor required to comply with these Rules and Regulations without any additional cost to District.

1.6 MOCK-UPS
A. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals and finishes.

B. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been accepted by District’s Representative.

C. Mock-ups: Full-size, physical assemblies that are constructed on site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work.
   1. Contractor shall build mockups in location and of size indicated, or if not indicated, as directed by Architect.
   2. Notify the District Representative five (5) working days in advance of dates and times when mockups will be constructed.
   3. Contractor shall demonstrate the complete range of aesthetic effects, details, and workmanship for the Work they represent.

1.7 INSPECTION AND TESTING LABORATORY SERVICES
A. See Section 01411 Testing Laboratory Services
1.8 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. Submit qualifications of observer to District and Architect 30 days in advance of required observations.

B. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, testing, adjusting, and balancing of equipment as applicable, and to provide instructions when necessary.

C. Manufacturer’s Field Representatives shall report to the Contractor and the District, any observations, site decisions, or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Provide by email PDF of Manufacturer’s Field Representative report to District for review within 7 days of field observation.

E. Manufacturer’s Field Service: Where indicated, engage a factory-approved service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01330 (Submittal Procedures.)

1.9 FIELD SAMPLES

A. Install field samples at the site for District and Architect review as required by individual Specifications Sections.

B. Samples accepted by the Architect in writing represent the quality level required for the Work.

C. Where a field sample is specified in individual sections to be removed, clear area after field sample has been accepted by Architect.

1.10 PROJECT INSPECTOR

A. District will employ a Project Inspector in accordance with the regulations of the DSA and subject to the provision of Part 1, Title 24, CCR.

B. Project Inspector's authority, rights and duties shall be as set forth in Section 4-342, Part 1, Title 24, CCR.

C. The Project Inspector shall make semi-monthly reports in writing to the Architect with copies forwarded to District, and the DSA in accordance with Section 4-337, Part 1, Title 24, CCR.

D. The Project Inspector shall notify the Division of the State Architect:
   1. When work is started on project.
   2. Minimum (2) working days in advance of time when foundation trenches will be complete and ready for footing forms.
   3. Minimum (2) working days in advance for first placing of concrete.
   4. When work is suspended for period of more than two weeks.

E. The Project Inspector shall keep records of certain phases of construction that shall be maintained on the project site until Final Completion. Upon Final Completion, these records shall be copied, with the original delivered to the District for the permanent school records and
the copy forwarded to the Architect. The record shall include, but is not limited, to the following:

1. The time and placing of concrete and the time and date of removal of forms in each portion of the structure.
2. Weighmasters tickets delivered with each load of concrete delivered to site.
3. Identification marks of welders, lists of defective welds, and manner of correction of defects.
4. Certification of grounding of electrical system.

F. The Project Inspector shall monitor the work of Special Inspectors and testing laboratories to ensure testing program is satisfactorily completed.

G. The Project Inspector shall notify the Contractor in writing of deviations from Contract Documents. Copies of such notice shall be forwarded immediately to the Architect, District and the Division of the State Architect (DSA).

H. The Project Inspector shall make and submit Verified Reports in accordance with Section 4-336, Part 1, Title 24, CCR. Verified Reports shall be submitted directly to the Division of the State Architect with a copy forwarded to the Architect.

I. The Project Inspector shall prepare detailed statements of fact regarding materials, operations and other related issues when requested by the District. Such statements shall be submitted directly to the District with a copy forwarded to the Architect.

J. The District may employ roofing and waterproofing specialist (e.g., other District inspectors, in addition to the Project Inspector to inspect and monitor application of roofing, waterproofing, and related flashings.

K. Contractor shall cooperate with the Project inspector and other District inspectors. Provide access to the work at all times whether it is in preparation or progress. Provide proper facilities for access and inspection.

L. Perform work with the knowledge of the Project Inspector. Cover no work prior to inspection.

M. Notify Project Inspector in writing at least (2) working days prior to expected time for operations requiring inspection.

N. If work is performed on Saturdays, Sundays, Holidays or beyond normal working hours, the Project Inspector, or other District inspectors, will be paid at overtime rates by the District. The cost of the Inspectors’ premium time will be deducted by the District from the Contract Price by Change Order.

O. The Contractor shall pay the cost of the Inspector’s salary for the time the Inspector is required on the project beyond the allotted Contract Time. The cost of the Inspector’s salary shall be in addition to liquidated damages and will be deducted by the District from the Contract Price by Change Order.

1.11 INSPECTION BY THE DIVISION OF THE STATE ARCHITECT

A. Work will be monitored and observed through periodic site visits by the Division of the State Architect Field Inspector according to Section 4-334, Part 1, Title 24, CCR.
1.12 CONFLICTS

A. Contractor shall comply with rules of documents interpretation as indicated in Contract General Conditions including, but not limited to the following items:

1. Contract Documents take precedence over statutory requirements or standard when requiring materials of higher quality or performance, or larger sizes or capacity, or greater protection, safety or quantity than required by said codes or standards.

2. This shall not operate to allow deviations from code requirements, prior approvals and other provisions as specified.

3. Modifications to published statutory requirements currently adopted or enforced by regulating agencies having jurisdiction shall take precedence over said published requirements.

B. Conflicts within Contract Documents and/or between Project Manual (including specifications) Drawings, Addenda: The more stringent requirement shall govern.

C. Subcontractor, supplier, and installer work may be called for in any section of the Contract Documents; Project Manual Specifications, Drawings and Addenda. Work by any one discipline is not limited to any specification section of the Project Manual, Drawings, Addenda, and Contract Documents shall be bid in total and not in parts.

D. If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to District with a copy to the Architect for a decision before proceeding. Contractor shall, within (15) working days, notify the District with a copy to the Architect in writing for the context of requirements.

E. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Contractor shall, within (15) working days, notify any uncertainties to the District with a copy to the Architect for a decision before proceeding.

1.13 QUALITY ASSURANCE

A. General: Qualifications requirements in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual with experience in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

1. Minimum Experience: 5 years or 5 similar projects, unless indicated otherwise.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and acceptable to authorities having jurisdiction.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST’s National Voluntary Laboratory Accreditation Program.

G. Factory-Authorized Service Representative Qualifications: An authorized representative who is trained and approved by manufacturer to inspect installation of manufacturer’s products that are similar in material, design, and extent to those indicated for this Project.

H. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups, to adequately demonstrate capability of products to comply with performance requirements.
   d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to District with a copy to the Architect and Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

I. Pre-work Meetings: The Contractor shall hold and document Pre-work Meetings for Subcontractors at least 5 work days prior to Subcontractors beginning work at the site for the first time. A copy of the completed New Subcontractor Preparatory Phase Checklist for each Pre-work Meeting shall be provided as an attachment to the Daily Report for that day, with a sign-in
sheet for all persons that were present at the meeting. The Checklist is provided at the end of this section.

1. The Pre-work Meeting shall be conducted in order to review and confirm the requirements of the Work per the Contract Documents, coordinate the Work, identify required tests and inspections, and establish a goal to obtain quality construction by planning ahead and identifying potential problems.

2. Notify the District at least three (3) work days in advance of each Pre-work Meeting. Conduct the Pre-work Meeting with the superintendent and the foreman responsible for the work and any District representatives that wish to attend.

3. Review the following at the Pre-work Meeting prior to allowing a Subcontractor to begin work on site:
   a. Review the General Conditions and other Contract Specifications governing work at the Project location. Review rules governing use of workspace, parking, laydown areas, conduct of employees, and access to and from the worksite.
   b. Review the Project Preconstruction Meeting Minutes and review pertinent portions with the new Subcontractor.
   c. Review each paragraph of the applicable technical specification sections;
   d. Review the Contract Drawings;
   e. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;
   f. Review the testing plan and ensure that provisions have been made to provide the required testing;
   g. Examine the work area to ensure that the required preliminary work has been completed;
   h. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;
   i. Review the Contractor’s approved Site Safety Plan and appropriate Activity Hazard review to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted;
   j. Establish the quality of workmanship required;
   k. Discuss specific controls used and the construction methods and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each definable feature of work.

1.14 QUALITY CONTROL, GENERAL

A. District will provide inspections, tests, and similar quality control services specified to be performed by independent agencies, except where indicated as Contractor’s responsibility. Costs for District-provided inspections and tests are not included in Contract Sum.

1. District will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Price will be adjusted by Change Order.

B. Where tests and inspections are indicated as Contractor’s cost and/or responsibility, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor’s responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by District, unless agreed to in writing by District.

2. Testing of equipment, systems, components, assemblies, and other non-structural elements of the Work that require testing shall be performed in accordance with the Contract Documents and Manufacturer’s recommended testing protocols. The Contractor shall submit Manufacturer’s Installation Instructions and Manufacturer’s recommended tests in accordance with Section 01330, Submittal Procedures, prior to installation and testing of equipment, systems, components, assemblies, and other non-structural elements of the Work. Test results shall be recorded and submitted original Manufacturer’s documents.

3. Notify Project Inspector and testing agencies, at least (5) working days or as indicated otherwise in advance of time when Work that requires testing or inspecting will be performed.

4. Where quality-control services are indicated as Contractor’s responsibility, submit a certified written report, in duplicate, of each quality-control service.

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor’s responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Re-inspecting:

1. Where quality-control services are Contractor’s responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaces or is necessitated by Work that failed to comply with the Contract Documents.

2. Where quality-control services are District’s responsibility, costs for retesting and re-inspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, by way of a deductive Change Order.

D. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work

2. Incidental labor and facilities necessary to facilitate tests and inspections

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.

5. Preliminary design mix proposed for use for material mixes that require control by testing agency.

6. Security and protection for samples and for testing and inspecting equipment at Project site.

E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities. Provide timely notice of the Work’s readiness for all required tests and inspections.

F. Testing and Inspection Log: The Contractor shall provide a detailed list of all Tests and Inspections required by the Contract Documents. Submit the Test and Inspection Log with the submittal of the Master CPM Schedule.

1. Distribution: Distribute schedule to District with a copy to the Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.15 QUALITY CONTROL PROGRAM

A. Information for the District: Prior to commencing Work, the Contractor may obtain a single copy set of the current report forms from the District. The report forms will consist of the Contractor Production Report, Contractor Production Report (Continuation Sheet), Contractor Quality Control (CQC) Report, CQC Report (Continuation Sheet), Preparatory Phase Checklist, Rework Items List, and Testing Plan and Log. Deliver the following to the District during Construction (email transmittal of Adobe pdf documents may be acceptable for reports in this section if approved in advance by the District):

1. CQC Report: Mail or hand-carry the original (wet signatures) and 2 copies by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work.

2. Contractor Production Report: Mail or hand-carry the original (wet signatures) and 2 copies by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work, attached to the CQC Report.

3. Preparatory Phase Checklist: Original attached to the original CQC Report and one copy attached to each QC Report copy.

4. Field Test Reports: Mail or hand-carry the original within two working days after the test is performed, attached to the original CQC Report and one copy attached to each QC Report copy.


6. Testing Plan and Log: Submit the report at the end of each month.

7. Rework Items List: Submit lists containing new entries daily, in the same manner as the CQC Report.

8. CQC Meeting Minutes: Provide within two working days after the meeting is held, attached to the original CQC Report and one copy attached to each CQC Report copy.

9. QC Certifications: As required herein.
B. QUALITY CONTROL PROGRAM REQUIREMENTS

1. Contractor shall establish and maintain a QC program as described in this section. This QC program is a key element in meeting the objectives of Quality Control and systems commissioning. The QC program consists of the Contractor Organization, QC Plan, a Coordination and Mutual Understanding Meeting, QC meetings, submittal review and certification, testing, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this Contract.
   a. The QA/QC program must cover on-site and off-site work and be keyed to the work sequence.
   b. No construction work or testing may be performed unless the QA/QC Manager is on the work site.
   c. The QA/QC Manager must report to an officer of the firm and not be subordinate to the Project Superintendent.
   d. The QA/QC Manager, Project Superintendent and other Contractor and Subcontractor personnel must work together effectively. Although the QA/QC Manager is the primary individual responsible for quality control, all individuals will be held responsible for the quality of work on the job.

2. Acceptance of the QA/QC Plan is required prior to the start of construction. The District reserves the right to require changes in the QA/QC Plan and operations as necessary, including removal of personnel, to ensure the specified quality of work.

3. The District reserves the right to interview any member of the Contractor’s organization at any time in order to verify the submitted qualifications.

4. The District may require the removal of any individual for non-compliance with quality requirements specified in the Contract.

C. Preliminary Construction Work Authorized Prior to Acceptance. The only construction work that is authorized to proceed prior to the acceptance of the QA/QC Plan is mobilization of storage and office trailers, temporary utilities, and surveying.

D. Notification of Changes: Notify the District, in writing, of any proposed changes in the QA/QC Plan or changes to the Contractor organization personnel, a minimum of 10 work days prior to a proposed change. Proposed changes are subject to acceptance by the District.

E. QA/QC Manager and Duties: Provide a Full Time on site QA/QC Manager at the Work site to implement and manage the QC program.
   1. The QA/QC Manager cannot serve in any other capacity on the project (e.g., project manager, superintendent, project engineer, etc.). The QA/QC Manager’s sole responsibility is to ensure the development and implementation of the Quality Control Program and to fulfill all other requirements of Section 01400. At a minimum, the QA/QC Manager shall visit the project site two days a week through the Contract Substantial Completion date; two work days prior to any concrete pours; erection of structural steel and when requested by the District Representative in writing to review any pertinent issues concerning the District or the Architect or Record.
   2. The QA/QC Manager is required to attend the weekly meetings, conduct new subcontractor Pre-Work Preparatory Phase meetings, perform submittal review and certification, ensure
testing is performed and provide QC certifications and documentation required in this Contract.

3. The QA/QC Manager is responsible for managing and coordinating the documentation performed by Contractor testing laboratory personnel and any other inspection and testing personnel required by this Contract not coordinated, overseen, and paid by the District.

4. Qualifications: A graduate of a four year accredited college or university program in one of the following disciplines: Engineering, Architecture, Construction Management, Engineering Technology, Building Construction, or Building Science, with a minimum of 15-20 years’ experience as a Project Superintendent, QA/QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract.

   a. The individual must be familiar with the requirements of DSA, OSHA and Cal OSHA, and have experience in the areas of hazard identification, safety compliance, and sustainability.

5. Alternate QA/QC Manager Duties and Qualifications: Designate an alternate for the QA/QC Manager at the work site to serve in the event of the designated QA/QC Manager's absence.

   a. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year.

   b. The qualification requirements for the Alternate QA/QC Manager must be the same as for the QA/QC Manager.

1.16 QUALITY CONTROL (QC) PLAN

   A. QC Plan Requirements: Provide, for acceptance by the District, a Construction QC Plan submitted in a three-ring binder that includes a table of contents, with major sections identified with tabs, with pages numbered sequentially, and that documents the proposed methods and responsibilities for accomplishing quality control and system commissioning activities during the construction of the Project and include:

   1. A chart showing the Contractor management organizational structure.

   2. Names and qualifications, in resume format, for each person in the Contractor management organization.

   3. Duties, responsibilities, and authorities of each person in the Contractor management organization, including home office personnel responsible for this Project.

   4. A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.

   5. Letters signed by an officer of the firm appointing the QA/QC Manager and Alternate QA/QC Manager and stating that they are responsible for implementing and managing the QC program as described in this Contract. Include in this letter their authority to stop work which is not in compliance with the Contract. Include copies of the letters in the QC Plan.


   7. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to submission to the District and Architect. Provide the initial submittal of the Submittal Log as specified in Section 01330 SUBMITTAL PROCEDURES.
8. Testing laboratory information required herein.

9. A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test. Use District forms to log and track tests.

10. Procedures to identify, record, track, and complete rework items. Use District forms to record and track rework items.

11. Procedures for coordinating, tracking and documenting all required certifications for subcontractors, testing laboratories, suppliers, personnel, etc.

B. QA/QC Manager shall ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the contract that the work is being performed.

C. Coordination and Mutual Understanding Meeting. After submission of the QC Plan, and prior to the start of construction, the QA/QC Manager will meet with the District to present the QC program required by this Contract. When a new QA/QC Manager is appointed, the coordination and mutual understanding meeting shall be repeated.

1. Purpose: The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, coordination of activities to be performed, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to explain in detail each management plan or requirement as listed below:
   b. Stormwater Pollution Prevention Plan
   c. Environmental regulatory requirements, including requirements related to Demolition.
   d. Noise Plan
   e. Commissioning Plan.
   f. Other plans required by the Contract Documents

D. Coordination of Activities: Coordinate activities included in various sections to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation. Coordinate pre-functional tests and startup testing with District and per the Contract Documents.

E. Attendees: As a minimum, the Contractor's personnel required to attend include an officer of the firm, the Project Manager, Project Superintendent, QA/QC Manager, Alternate QA/QC Manager, A/E, and subcontractor representatives. Minutes of the meeting will be prepared by the QA/QC Manager and signed by the Contractor and the District. Provide a copy of the signed minutes to all parties.

F. Agenda Items Include:

1. Review of the Contract Documents to verify that requirements related to systems commissioning are adequately specified, and that each commissioned system is likely to meet the design intent relative to functionality, energy performance, water performance,
maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts.

2. Procedures for submission, review and approval of submittals are also described in Section 01330 SUBMITTAL PROCEDURES.

3. Review of sampling and testing procedures required under this Contract.

1.17 QUALITY CONTROL: LABORATORY, TESTS, AND REPORTING REQUIREMENTS

A. Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation.

1. The laboratory's scope of accreditation must include the appropriate ASTM standards (E 329, C 1077, D 3666, D 3740, A 880, E 543) listed in the technical sections of the specifications.

B. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

C. Laboratory Accreditation Authorities: Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at: http://ts.nist.gov/ts/htdocs/210/214/214.htm the American Association of State Highway and Transportation Officials (AASHTO) program at http://www.transportation.org/aashto/home.nsf/frontpage, International Accreditation Services, Inc. (IAS) at http://www.iasonline.org, the American Association for Laboratory Accreditation (A2LA) program at http://www.a2la.org/.

D. Capability Check: The District retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

E. Test Results: Reference applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item test or analyzed conforms or fails to conform to specified requirements.

1. If the item fails to conform, notify the District immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable.

2. Test results must be signed by a testing laboratory representative authorized to sign certified test reports.

3. Furnish the signed reports, certifications, and other documentation to the District via the QA/QC Manager.

4. Furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the District. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.
1.18 QC CERTIFICATIONS AND DOCUMENTATION

A. CQC Report Certification. Contain the following statement within the CQC Report:

"On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge, except as noted in this report."

B. Invoice Certification. Furnish a certificate to the District with each payment request, signed by the QA/QC Manager, attesting that as-built drawings are current and, coordinated, and attesting that the work for which payment is requested, including stored material, is in compliance with Contract requirements.

C. Documentation: Maintain current and complete records of on-site and off-site QC program operations and activities.

D. Construction Documentation: Reports are required for each day that work is performed and must be attached to the Contractor Quality Control (CQC) Report prepared for the same day.
   1. Maintain current and complete records of on-site and off-site QC program operations and activities on the required forms.
   2. Reports are required for each day work is performed.
   3. Account for each calendar day throughout the life of the Contract.
   4. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces.
   5. The Project Superintendent and the QA/QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively.
   6. The reporting of work must be identified by terminology consistent with the Master CPM Schedule.
   7. In the "remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, Work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, meetings held.
   8. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

E. Quality Control Validation. Establish and maintain the following in a series of three ring binders. Binders shall be divided and tabbed as shown below. These binders must be readily available to the District during all business hours.
   1. All completed Preparatory Phase Checklists, arranged by specification section.
   2. All milestone inspections, arranged by Activity Number.
   3. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.
   4. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.
5. An up-to-date copy of the Rework Items List.

6. Maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and Sub-Contractors and all punch lists issued by the District.

7. Commissioning documentation including checklists, schedules, tests, and reports.

F. Testing Plan and Log:
   1. As tests are performed, the QA/QC Manager will record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the District.
   2. Attach a copy of the updated "Testing Plan and Log" to the last daily CQC Report of each month.

G. Rework Items List: The QA/QC Manager must maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered.
   1. The Contractor is responsible for including rework items identified by the District or its representative.

H. As-Built Drawings: The QA/QC Manager is required to ensure the as-built drawings, required by Section 01780, Project Record Documents are kept current on a daily basis and marked to show deviations which have been made from the Contract Drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. PCO No., CO No., Request for Information No., etc.). The QA/QC Manager must initial each revision.
   1. Upon Substantial Completion of Work, the QA/QC Manager will furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the District.

1.19 NOTIFICATION ON NON-COMPLIANCE

A. The District will notify the Contractor of any detected non-compliance with the Contract. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the District may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time for excess costs or damages by the Contractor.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work constitutes acceptance of existing conditions by the Contractor.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.
D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to District and Architect.
4. Identification of testing agency or special Inspector conducting test or inspection.

B. Maintain test and inspection log at project site. Post changes and modifications as they occur. Provide access to test and inspection log for District or its representative’s reference during normal working hours.

3.3 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.
B. Seal cracks or openings of substrate prior to applying next material or substance.
C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.4 PREPARATION AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes. See also Section 01730, Cutting and Patching.
B. Protect construction exposed by or for quality-control service activities.
C. Repair and protection are Contractor’s responsibility, regardless of the assignment of responsibility for quality-control services.
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<th>PERSONNEL PRESENT</th>
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<td>DISTRICT REP NOTIFIED</td>
<td>_____</td>
<td>HOURS IN ADVANCE:</td>
<td>YES</td>
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<tr>
<td>REVIEW SUBMITTALS AND/OR SUBMITTAL REGISTER. HAVE ALL SUBMITTALS BEEN APPROVED?</td>
<td></td>
<td>YES</td>
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<td>IF NO, WHAT ITEMS HAVE NOT BEEN SUBMITTED?</td>
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<td>ARE ALL MATERIALS ON HAND?</td>
<td>YES</td>
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<td>IF NO, WHAT ITEMS ARE MISSING?</td>
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<td>CHECK APPROVED SUBMITTALS AGAINST DELIVERED MATERIAL. (THIS SHOULD BE DONE AS MATERIAL ARRIVES.)</td>
<td>COMMENTS:</td>
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<td>ARE MATERIALS STORED PROPERLY?</td>
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<td>IF NO, WHAT ACTION IS TAKEN?</td>
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<td>REVIEW EACH PARAGRAPH OF SPECIFICATIONS.</td>
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<td>DISCUSS PROCEDURE FOR ACCOMPLISHING THE WORK.</td>
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<td>CLARIFY ANY DIFFERENCES.</td>
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### Preliminary Work & Permits

**Ensure preliminary work is correct and permits are on file.**

If not, what action is taken?

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### Testing

Identify test to be performed, frequency, and by whom.

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Review testing plan.

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Have test facilities been approved?

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<th>YES</th>
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### Safety

Activity hazard review conducted?

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Review applicable portion of safety plan.

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### Meeting Comments

District comments during meeting.

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### Other Items or Remarks

Other items or remarks:

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Site Superintendent:

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Contra Costa Community College District

Diablo Valley College

D-4002 SRC Increment 2 – Expansion & Renovation

Section 01400 - Page 20 of 20

Quality Control Requirements
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
   A. Divisions 2 through 28 Sections for Regulatory requirements for the work in those sections.

1.3 SUMMARY
   A. This Section includes regulatory requirements applicable to the Contract Documents and the Project and Work.
   B. Specific reference in the Specifications to codes and regulations or requirements of regulatory agencies shall mean the latest printed edition of each adopted by the regulatory agency in effect at the time of the opening of Proposals, except as may be otherwise specifically stated in the Contract Documents.
   C. No change order shall be considered for any change in any applicable federal, state or local code or regulation if similar language existed in an alternate applicable regulation in force at the time of opening of Bids.
   D. Contractor shall not allow design or construction of any conditions wherein the finished Work will not comply with current applicable codes. No change order shall be considered by District for the Work correction of any Work not complying with code.
   E. This section shall cover the general requirements for regulatory requirements pertaining to the Work and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the Contract Documents.

1.4 REFERENCES TO REGULATORY REQUIREMENTS
   A. Code, laws, ordinances, rules and regulations referred to shall have full force and effect as though printed in full in these Specifications. Code, laws, ordinances, rules and regulations are not furnished to Contractor because Contractor is assumed to be and shall be familiar with these requirements, including readily available access to these requirements. The listing of applicable codes, laws, and regulations for hazardous waste abatement Work in the Contract Documents is supplied to Contractor as a courtesy and shall not limit Contractor’s responsibility for complying with all applicable laws, regulations or ordinances having application to the Work. Where conflict among the requirements or with these Specifications occurs, the most stringent requirements shall be used with no change in Contract Sum or Contract Time.
   B. Contractor shall conform to all applicable federal, state, and local codes, laws, ordinances, rules and regulations, whether or not referenced in the Contract Documents.
   C. Precedence:
1. Where specified requirements differ from the requirements of applicable codes, ordinances and standards, the more stringent requirements shall take precedence.

2. Where Contract Documents require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, Contract Documents shall take precedence so long as such increase is legal.

3. Where no requirements are identified on Contract Documents, comply with all requirements of applicable codes, ordinances and standards of governing authorities have jurisdiction.

1.5 REGULATORY REQUIREMENTS

A. All statutes, ordinances, laws, rules, codes, regulations, standards, and lawful orders of all public authorities have jurisdiction of the Work, are hereby incorporated into these Contract Documents as if repeated in full herein and are intended to be included in any reference to Code or Building Code, unless otherwise specified, including, without limitation, the references in the list below. Contractor shall make available at the Site, copies of all the listed documents applicable to the Work as the District and/or Architect may request, including, without limitation, applicable portions of the California Code of Regulations ("CCR").

B. This Project shall be governed by applicable regulations, including, without limitation, the State of California’s Code Section Group 1, Chapter 4, Part 1, Title 24, CCR, and the most current version on the date the bids are opened and as it pertains to school construction including, without limitation:

1. Test and testing laboratory per Section 4-335 (District shall pay for the testing laboratory.)
2. All special inspections per Section 4-333(c).
3. Contractor shall submit verified reports per Section 4-365 & 4-343(c).
4. Administration
   a. Duties of the Architect & Engineers shall be per Section 4-333(a) & 4-341.
   b. Duties of the Contractor shall be per Section 4-343.
   c. Verified Reports per Section 4-336.
5. Contractor shall keep and make available a copy of Part I and II of the most current version of Title 24 at the Site during construction.
6. Contractor shall notify the Division of State Architect ("DSA") upon the start of construction per Section 4-334 if applicable.
7. Addenda and Change Orders per Section 4-338.

1.6 CODES

A. Codes that apply to Contract Documents include, but are not limited to, the following:

5. California Elevator Safety Construction Code, Part 7, Title 24 C.C.R.
7. Public Safety, Title 19, California Code of Regulations, State Fire Marshal Regulations
13. California Code of Regulations (CCR):
   a. Title 8, Industrial Relations (Cal/OSHA Standards).
   b. Title 24, State Access Compliance.
14. California Air Resources Board (CARB), and in particular Rule 1113.
16. State Water Resources Control Board Waste Discharge Requirements
17. County ordinances and regulations.
18. Other codes as specified.

1.7 LAWS, ORDINANCES, RULES, AND REGULATIONS

A. During prosecution of Work to be done under Contract Documents, comply with applicable laws, ordinances, rules and regulations, including, but not limited to, the following:

1. Federal:
   b. 29 CFR, Section 1910.1001, Asbestos
   c. 40 CFR, Subpart M, National Emission Standards for Asbestos
   d. Executive Order 11246
   e. Federal endangered Species Act
   f. Clean Water Act

2. State of California:
   a. California Code of Regulations, Titles 5, 8, 19, 21, 22, 24 and 25
   b. California Public Contract Code
   c. California Health and Safety Code
   d. California Government Code
   e. California Labor Code
   f. California Civil code
   g. California Code of Civil Procedure
   h. CPUC General Order 95, Rules for Overhead Electric Line Construction
i. CPUC General Order 128, Rules for Construction of Underground Electric Supply and Communications systems
j. Cal/OSHA
k. OSHA: Hazard Communications Standards
l. California Endangered Species Act
m. Water Code

3. State of California Agencies:
   a. State and Consumer Services Agency
   b. Office of the State Fire Marshall
c. Not used
d. Bay Area Air Quality Management District
e. San Francisco Bay Regional Water Quality Control Board
f. Division of the State Architect

4. Local Agencies:
   a. City of [edit], California
   b. Contra Costa County Fire Department

5. Other Requirements:
   b. References on Drawings on in specifications to “code” or “building code” not otherwise identified shall mean the codes specified in this Section 1410 together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction.

B. Contractor shall have immediate access to all of the foregoing.

C. Other Applicable Laws, Ordinances and Regulations:
   1. Work shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of federal, state, and local governmental agencies and jurisdictions having authority over the Project.
   2. Work shall be accomplished in conformance with all rules and regulations of public utilities and utility districts.
   3. Where such laws, ordinances, rules and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to the Contract Time and Contract Sum, except where changes in laws, ordinances, rules and regulations occur subsequent to the time of opening of the Proposals.

D. Under California Government Code Section 930.2 et. Seq. and Public Contract Code Section 7105(d)(2), neither the Contract Claims Procedure nor the Change Order Procedure may be modified, waived, or otherwise not complied with, absent a written change order that explicitly and expressly makes such modifications.

1.8 CONFLICTS

A. Between reference regulatory requirements: Comply with the one establishing the more stringent requirement.
1.9 **COMPLIANCE WITH AMERICANS WITH DISABILITIES ACT**

A. Contractor acknowledges that, pursuant to the Americans with Disabilities Act (ADA), programs, services and other activities provided by a public entity to the public, whether directly or through a contractor, must be accessible to people with disabilities. Contractor shall provide the services specified in the Contract Documents in a manner that complies with the ADA and any and all other applicable federal, state and local disability rights legislation. Contractor agrees not to discriminate against people with disabilities in the provision of services, benefits, or activities provided and further agrees that any violation of this prohibition on the part of Contractor, its employees, agents or assigns shall constitute a material breach of the Contract Documents.

**PART 2 - PRODUCTS**
Not Used.

**PART 3 - EXECUTION**
Not Used.

**END OF SECTION 01410**
SECTION 01411
TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01400 – “Quality Control Requirements”
C. Section 01410 – “Regulatory Requirements”
D. Section 01412 – “Hazardous Material”
E. Section 01770 – “Contract Closeout Procedures”
F. Division 2 through 33 Sections for Special Inspections, tests required and standard for testing.

1.3 SUMMARY
A. This section describes the requirements and procedures for work involving the testing laboratory.

1.4 REFERENCES
A. CBC - California Building Code.
B. CCR - California Code of Regulations.
D. ANSI/ASTM E329 – Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction.

1.5 REGULATORY REQUIREMENTS
A. Testing, sampling and preparing samples will be in accordance with the standards referenced in individual specification sections and in the applicable sections of CBC State Chapters.
B. Testing and submitting test reports will conform to provisions of Section 4-335, Part 1, Title 24, CCR.
D. Laboratory shall maintain a full-time registered Engineer on staff to review services.
E. Laboratory authorized to operate in State in which Project is located.
F. Testing Equipment shall be calibrated at reasonable intervals with devices of accuracy traceable to either NSB Standards or accepted values of natural physical constants.
1.6 **SELECTION AND PAYMENT**

A. The District will employ and pay for the services of testing laboratory and/or testing agencies acceptable to the Division of the State Architect to conduct required tests and inspections for the Project.

1. Soils: The testing laboratory will observe excavating, grading, and filling operations and provide testing of soil materials as required by the Division of the State Architect and as specified in the Contract Documents. The Soils Engineer will have management, laboratory and field supervisory personnel with minimum 5 years experience in testing and inspection of soils materials and will have adequate facilities, equipment, and technical references to permit performance of testing and inspections within applicable regulations and standards in accordance with Section 4-335, Part 1, Title 24, CCR.

2. Other Construction: The testing laboratory will conduct tests, inspections, and special inspections as required by the Division of the State Architect and as specified in the Contract Documents.
   a. Construction Requiring Testing and Inspection Other Than Special Inspection: The testing laboratory will have management, laboratory and field supervisory personnel with minimum 5 years experience in testing and inspection of work and materials of construction and will have adequate facilities, equipment, and technical references to permit performance of testing and inspections within applicable regulations and standards in accordance with Section 4-335, Part 1, Title 24, CCR.
   b. Construction Requiring Special Inspection: The testing laboratory will have special inspectors approved by the Division of the State Architect to conduct special inspections as required by the Division of the State Architect under provisions of Section 4-333, Part 1, Title 24, CCR.

B. Retesting: When initial tests indicate non-compliance with the Contract Documents, subsequent retesting caused by the non-compliance shall be performed by the same testing agency and the costs thereof will be deducted by the District from the Contractor’s Contract Price by Change Order.

C. Retesting Covered Work: Re-examination of previously tested and inspected work may be ordered by the District. The Contractor shall uncover such work if retesting is ordered. If work is found in accordance with Contract Documents, the District will pay costs of uncovering, removing, retesting and replacing. If work is found not in accordance with Contract Documents, the District will deduct the cost of retesting from the Contract Price by Change Order and the Contractor will bear the costs of uncovering, removing and replacing work.

D. Testing and inspecting performed for Contractor’s convenience, such as testing and inspection to establish equivalence of substitutions, equivalence of repairs to damaged materials, and testing and inspecting to expedite the operations, shall be the Contractor’s responsibility.

1. The Contractor shall employ a licensed professional engineer of the discipline required to develop a testing program which will establish equivalency.

2. The Contractor shall submit the testing program to the District for review.
3. The Contractor shall arrange testing in accordance with the accepted testing program to be performed by the District's testing laboratory.

4. The costs of testing done by the District's testing laboratory for the Contractor will be deducted from the Contract Price by Change Order.

5. The Contractor may not arrange for testing upon portions of the work already completed except with the written consent of the District and Architect.

E. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

F. The District shall have the right to make tests at any time on materials or work done whether those materials are specified or substituted items.

1.7 LABORATORY RESPONSIBILITIES


B. Perform specified sampling and testing of materials in accordance with specified standards.

C. Ascertain compliance of materials and mixes with requirements of Contract Documents.

D. Promptly notify Division of the State Architect, District, Project Inspector and Contractor of observed irregularities and non-conformance of work and products.

E. Perform additional tests required by District, and Division of the State Architect.

F. Attend Pre-Construction Meeting, Progress Meetings and other meetings as requested by District.

G. Perform all tests required by the Division of the State Architect for this Project. See form DSA-103 in this Project Manual and individual specification sections.

1.8 LABORATORY REPORTS

A. Test/Inspection Reports:

1. Reports will comply with Section 4-335(d), Part 1, Title 24, CCR.

2. Include every test and inspection made regardless of whether such tests and inspections indicate that the material and procedures are satisfactory or unsatisfactory.

3. Include records of special sampling operations as required.

4. Indicate that materials were sampled and tested in accordance with requirements of CCR regulations and Construction Documents.

5. Indicate specified design strength of materials such as masonry, concrete and steel.

6. State whether or not materials and procedures comply with requirements of the Contract Documents.

7. Submit copies of reports to Division of the State Architect, District, Project Inspector, and Contractor within 14 days of tests. Submit copies of reports of non-complying materials and procedures immediately.

B. Verified Reports:
1. Soils Engineers inspecting placement of fills and Special Inspectors will submit Verified Reports in accordance with Section 4-336, Part I, Title 24, CCR.
   a. Special inspections requiring Verified Reports include, but are not limited to, inspections of masonry construction, glued-laminated timber fabrication, wood framing using timber connectors, manufactured trusses, ready-mixed concrete batting, shotcrete application, shop welding and field welding.
   b. Submit two copies of reports directly to the Office of Regulation Services; forward one copy each to District, Architect and Project Inspector.

2. Soils Engineers and testing laboratories conducting tests on materials will submit verification of test reports at completion of testing program and when required by Office of Regulation Services in accordance with Section 4-335(e), Part I, Title 24, CCR.
   a. The Final Laboratory Verified Report or Laboratory Affidavit will indicate whether every material tested passed and disposition of problems associated with earlier deficient test reports.
   b. Submit two copies of each report directly to Office of Regulation Services; forward one copy each to District and Project Inspector.

1.9 LIMITS ON AGENCY OR TESTING LABORATORY AUTHORITY
   A. Agency or laboratory may not release, revoke, alter or enlarge on requirements of Contract Documents.
   B. Agency or laboratory may not approve or accept any portion of the work.
   C. Agency or laboratory may not assume any duties of Contractor.
   D. Agency or laboratory has no authority to stop work.

1.10 CONTRACTOR RESPONSIBILITIES
   A. Package and deliver to laboratory at designated location adequate samples of materials proposed to be used which require testing. Samples shall be selected by laboratory personnel. Allow proper time for selecting samples and making tests or considerations.
   B. Cooperate with laboratory personnel and provide access to work and to manufacturer's facilities.
   C. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples as selected by laboratory personnel at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.
   D. Schedule all tests and inspections with the testing and inspections firm and to notify District and Project Inspector a minimum of 3 working days prior to expected time for operations requiring inspection and testing services. Do not allow work to be covered prior to inspection and testing.
   E. Cooperate fully with the testing laboratory’s personnel and with special inspectors in inspecting any part of the construction and in taking any samples of materials required to be tested. Provide access to the work. The Contractor’s personnel shall furnish and cut or prepare all samples in the presence of either the testing laboratory personnel or the special inspectors and secure the witness’s initial on each sample prepared.
F. Notify the testing laboratory to send a bonded messenger to pick up the initialed samples the same day the samples were prepared. Alert the testing laboratory 3 working days in advance as to the times and location of the required sampling, tests and inspections so as to not delay the work of the project, and make sure that the required sampling, tests inspections are promptly completed.

1.11 INSPECTIONS AND TESTS

Required inspections and tests may include, but are not limited to, the following:

A. Testing Certificates to be provided by Contractor:
   1. Mill test reports for reinforcing steel.
   2. Mill test reports for cement.
   3. Weighmaster’s tickets for each load of transmit mixed concrete.
   4. Weighmaster’s affidavit.
   5. Certifications of welders.
   6. Certifications of materials.

B. Initial Testing Provided by District:
   1. Site Clearing: Test compaction of excavation backfill.
   2. Earthwork:
      a. Sample and test fill and base materials for compliance with specified requirements.
      b. Inspect placement of engineered fill.
      c. Inspect bottoms of footings and foundation trenches.
      d. Test compaction of each layer of engineered fill.
   3. Trenching:
      a. Inspect placement of trench backfill.
      b. Test compaction of trench backfill.
   4. Asphaltic Concrete Paving:
      a. Sample and test quality of paving and base if directed by District.
      b. Test compaction of paving and base if directed by District.
   5. Portland Cement Concrete Paving:
      a. Review mix designs.
      b. Sample and test compressive strength of concrete.
      c. Sample and test slump of concrete.
   6. Concrete Reinforcing:
      a. Review mill tests.
      b. Sample and test unidentified reinforcing steel.
      c. Sample and test identified reinforcing steel.
d. Inspect placement and installation of reinforcing steel.
e. Inspect field welding of reinforcing steel.

7. Cast-In-Place Concrete:
   a. Sample and test cement.
   b. Sample and test aggregate.
   c. Review mix designs and confirm mix design proportions with weighmaster.
   d. Perform initial batch plant inspection.
   e. Inspect concrete placement.
   f. Sample and test slump of concrete.
   g. Test air content of concrete.
   h. Sample and test concrete for compressive strength.
   i. Test concrete for shrinkage.

8. Structural Steel:
   a. Review mill certificates for shapes and plates.
   b. Sample and test unidentified steel.
   c. Establish recommended procedures for shop and field welding.
   d. Inspect shop and field welding, including welded studs.
   e. Test full penetration welds.

9. Metal Fabrications:
   a. Inspect shop and field welding of load bearing fabrications.
   b. Test full penetration welds in load bearing fabrications.


C. The cost of the following initial tests, if required, will be deducted by the District from the Contract Price by Change Order.

   1. Testing to establish equivalence of material not properly identified.
   2. Testing to establish equivalence of substitutions.
   3. Testing required to expedite Contractor's operations.
   4. Testing relating to repair of work which fails to meet specifications.
   5. Testing and inspection required to correct damage to material in shipping and erection.

PART 2 - PRODUCTS
Not Used

PART 3 – EXECUTION
Not Used

END OF SECTION 01411
SECTION 01412
HAZARDOUS MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provision in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01311 – “Project Management and Coordination”
C. Section 01312 – “Project Meetings”
D. Section 01420 – “References”
E. Section 01572 – “Storm Water Pollution Prevention Plan ‘SWPPP’”
F. Divisions 2 through 33 Sections for Hazardous Materials requirements for the work in those Sections.

1.3 SUMMARY
A. This Section describes Project requirements applicable to Work in connection with hazardous materials, hazardous waste, abatement and disposal including, but not limited to, asbestos and asbestos-containing materials, lead-based paint, polychlorinated biphenyls, petroleum-contaminated soils and materials, construction and demolition debris and any other hazardous substance or hazardous waste. This Section supplements the requirements elsewhere in the Contract Documents.

1.4 DISCOVERY OF HAZARDOUS MATERIALS
A. In the event the Contractor encounters or suspects the presence on the Site of material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), or any other material defined as being hazardous by § 25249.5 of the California Health and Safety Code, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the District and copy the Architect in writing, whether or not such material was generated by the Contractor or the District. The Work in the affected area shall not thereafter be resumed, except by written agreement of the District and the Contractor, if in fact the material is asbestos, polychlorinated biphenyl (PCB), or other hazardous material, and has not been rendered harmless. The Work in the affected area shall be resumed only in the absence of asbestos, polychlorinated biphenyl (PCB), or other hazardous material, or when it has been rendered harmless by written agreement of the District and the Contractor.

B. If hazardous materials are encountered, they shall be handled in accordance with applicable local, state and federal regulation which may include: (1) CCR Title 8, Division 4, Chapter 4,
Sections 5163 through 5167 and 5192 (Hazardous Waste Operations and Emergency Response); (2) CCR Title 22, Division 4.5, Chapters 10 through 13 and 18 (Environmental Health Standards for Management of Hazardous Waste); and (3) CCR Title 23, Division 3, Chapter 15 (Discharges of Hazardous Waste to Land).

C. Should the discovery of contaminants cause delay to Contractor’s operation, extension of Contract Time will be granted by District in accordance with Section 00700 (General Conditions) and Section 01310 (Construction Scheduling.) Contractor may not be entitled to damages or additional payment due to such delays. District may, if it believes appropriate in its sole discretion, grant an extension of Contract Time.

D. The Contractor shall take all measures to avoid and/or mitigate delays due to Hazardous Materials/Waste finds such as; avoiding the area of the find and proceeding with other work on the project; developing “work around” plans; and documenting his best efforts to avoid and/or mitigate delays. See Section 01310 (Construction Scheduling) regarding requirement to demonstrate Time Impacts.

1.5 SUBSURFACE HAZARDOUS MATERIALS

A. If Contractor encounters surface contamination, the following provisions and precautionary measures shall be implemented during construction.

1. Contractor’s personnel shall be alert for and immediately report to the District any detectable chemical odors, unusual debris, or discolored soil.

2. Disposal requirements: Soils containing hazardous materials shall be disposed by Contractor at permitted treatment, recycling, or disposal facilities in accordance with CCR Title 23, Division 3, Chapter 15 (Discharge of Waste to Land). Determine to which permitted treatment, recycling, or disposal facilities the soil will be delivered.

3. Dewatering: Construct, operate and maintain as required by applicable laws, codes and standards and to complete the Work all necessary cofferdams, channels, pipes, flumes, drains, sumps, well points and protective works; and furnish, install, operate and maintain all necessary pumping and other equipment for dewatering the areas of Work suspected of containing hazardous materials; and control all surface flow and groundwater as may be encountered while performing the Work. Remove all water that may accumulate in the excavation while the Work progresses so that all Work can be performed in dry conditions. All contaminated water shall be removed from the excavation before it is backfilled. The excavation shall be kept free from water until backfilling has progressed to a height above the water source.

4. Water sampling and chemical analysis: Water samples shall be collected from the holding tanks and submitted to a State-Certified chemical analysis laboratory. Chemical analyses required for the samples shall at a minimum include: TPHg following EPA Test Methods 5030/8015 (modified); benzene, toluene, ethyl benzene and total xylenes (BTEX) following EPA Test Method 8020; and chlorinated solvents following EPA Test Method 8010. Perform additional chemical analyses that may be required for disposal or recycling of the water.

5. Laboratory chemical analysis reports associated with the water samples shall be provided to District’s Representative.
6. Removal of dewatering equipment: After having served their purpose, all protective works and dewatering pumps, shall be decontaminated and removed from the Site. Contractor is responsible for permanent disposal of all equipment that cannot be decontaminated or recycled in accordance with all applicable laws and regulations.

7. Fees: Pay for any fees associated with the treatment, recycling, or disposal of these soils. Any additional soil sampling and chemical analyses required for acceptance of the soil at facilities other than those described above may be deemed to be the responsibility of the Contractor.

8. Transport: Transport the soils to the selected facilities under approved manifests and submit copies of these manifests and the facility weight tickets to District’s Representative.

1.6 HAZARDOUS MATERIAL WORK LIMITATIONS

A. In the event that the presence of hazardous materials is suspected or discovered on the Site (except in cases where asbestos and other hazardous material work is the Contractor’s responsibility), the District shall retain an independent testing laboratory to determine the nature of the material encountered and whether corrective measures or remedial action is required. The Contractor shall not be required pursuant to Specification Section 01250 to perform without consent any Work in the affected area of the Site relating to asbestos, polychlorinated biphenyl (PCB), or other hazardous material, until any known or suspected hazardous material has been removed, or rendered harmless, or determined to be harmless by District, as certified by an independent testing laboratory and approved by the appropriate government agency.

B. To protect construction workers and members of the public from known or undiscovered hazardous building materials, including asbestos and lead, undertake all demolition activities in accordance with Cal-OSHA standards, contained in Title 8 of the California Code of Regulations (CCR). See Hazardous Materials Removal Specifications (02080, 02081, 02082 and 02085) and Reports for additional requirements.

C. During demolition activities, all building materials containing lead paint shall be removed in accordance with Cal-OSHA Lead in Construction Standard, title 8 and California Code of Regulations 1532.1.

D. All potentially friable asbestos-containing materials (ACMs) shall be removed in accordance with National Emissions Standards for Hazardous Air Pollutants (NESHAP) guidelines prior to building demolition or renovation that may disturb the materials. Applicable standards include the following:

1. The facility shall be inspected before any renovation occurs in which 160 square feet or more of building materials or 260 linear feet or more of pipe insulation will be disturbed at a regulated facility or any demolition occurs at a regulated facility.

2. An asbestos notification form shall be submitted to the Bay Area Air Quality Management District (BAAQMD) for any regulated asbestos abatement project or regulated demolition 10 working days before the activity begins.

3. If ACMs are discovered during a renovation or demolition, they must be removed before the project may proceed. Also, the Cal-OSHA and California Environmental Protection Agency (Cal-EPA) hazardous waste regulation apply in most cases.
E. No Work will be accepted until asbestos contamination is reduced to levels deemed acceptable by the District’s asbestos consultant.

F. Interface of Work under this Contract with work containing asbestos shall be executed by the Contractor at his risk and at his discretion, with full knowledge of the currently accepted standards, hazards, risks, and liabilities associated with asbestos work and asbestos-containing products. By execution of this Contract, the Contractor acknowledges the above and agrees to hold harmless District and its assigns for all asbestos liability which may be associated with this work and agrees to instruct his employees with respect to the above-mentioned standards, hazards, risks, and liabilities.

1.7 INDEMNIFICATION BY CONTRACTOR FOR HAZARDOUS MATERIAL CAUSED BY CONTRACTOR

A. In the event the hazardous materials on the Site is caused by the Contractor, the Contractor shall pay for all costs of testing and remediation, if any, and shall compensate the District for any additional costs incurred as a result of Contractor’s generation of hazardous material on the Site. In addition, the Contractor shall defend, indemnify and hold harmless District and its agents, officers, and employees from and against any and all claims, damages, losses, costs and expenses incurred in connection with, arising out of, or relating to, the presence of hazardous material on the Site.

1.8 TERMS OF HAZARDOUS MATERIAL PROVISION

A. The terms of this Hazardous Material provision shall survive the completion of the Work and/or any termination of this Contract.

1.9 NON-UTILIZATION OF ASBESTOS MATERIAL

A. NO ASBESTOS OR ASBESTOS-CONTAINING PRODUCTS SHALL BE USED IN THIS CONSTRUCTION OR IN ANY TOOLS, DEVICES, CLOTHING, OR EQUIPMENT USED TO AFFECT THIS CONSTRUCTION.

B. Asbestos and/or asbestos-containing products shall be defined as all items containing, but not limited to, chrysotile, amosite, anthophyllite, tremolite, and antinolite.

C. Any or all material containing greater than one-tenth of one percent (>.1%) asbestos shall be defined as asbestos-containing material.

1.10 REMOVAL OF CONTRACTOR INSTALLED ASBESTOS MATERIALS

A. All Work or materials found to contain asbestos or Work or material installed with asbestos-containing equipment will be immediately rejected and this Work will be removed at no additional cost to the District.

1. Decontamination and removal of Work found to contain asbestos or Work installed with asbestos-containing equipment shall be done only under supervision of a qualified consultant, knowledgeable in the field of asbestos abatement and accredited by the Environmental Protection Agency.

2. The asbestos removal contractor shall be appropriately licensed and registered, qualified in the removal of asbestos and shall be approved by the asbestos consultant, who shall have sole discretion and final determination in this matter.
3. The asbestos consultant shall be approved by the District, who shall have sole discretion and final determination in this matter.

1.11 NATURALLY OCCURRING ASBESTOS

A. To protect construction workers and members of the public from exposure to known areas of naturally-occurring asbestos (NOA), all ground disturbing activities will be undertaken in accordance with all applicable Cal-OSHA standards, contained in Title 8 of the California Code of Regulations (CCR). In addition, any ground-disturbing activity in an area that meets one or more of the applicability criteria for the Asbestos Airborne Toxic Control Measure (ATCM) for Construction, Grading, Quarrying and Surface Mining Operations, as adopted by the California Air Resources Board (CARB), is subject to the requirements therein, Per Section 93105 (b) of the ATCM, these criteria are as follows:
   1. The area to be disturbed is located in a geographic ultramafic rock unit; or
   2. The area to be disturbed has naturally-occurring asbestos, serpentine, or ultramafic rock as determined by the District, or the Air Pollution Control Officer (APCO); or
   3. Naturally-occurring asbestos, serpentine, or ultramafic rock is discovered by the District, a registered geologist, or the APCO in the area to be disturbed after the start of any construction, grading, quarrying, or surface mining operation.

1.12 REFERENCES TO REGULATORY REQUIREMENTS

A. Codes, laws, ordinances, rules and regulations applicable to the Work shall have full force and effect as though printed in full in the Contract Documents. Codes, laws, ordinances, rules and regulations are not furnished to Contractor, because Contractor is assumed to be familiar with their requirements. The listing herein of applicable codes, laws, and regulations for hazardous waste abatement work is supplied to Contractor as a courtesy and shall not limit Contractor’s responsibility for complying with all applicable laws, regulations or ordinances having application to the Work. Where conflict among the requirements or with these Contract Documents exists, the most stringent requirements shall be used.

B. Conform to all applicable codes, laws, ordinances, rules and regulations that are in effect on date of contracting.

1.13 LAWS, ORDINANCES, RULES, AND REGULATIONS

A. During prosecution of Work under Contract Documents, Contractor shall comply with applicable laws, ordinances, rules and regulations including, but not limited to, those listed below.

B. Federal:
   1. Statutory Requirements:
      f. Safe Drinking Water Act, 42 U.S.C., Sections 3001 et seq.
g. Clean Air Act, Section 112, 42 U.S.C., Section 7412  
i. Underground Storage Tank Law, 42 U.S.C., Sections 6991 et seq.  
j. The Emergency Planning and Community Right to Know Act of 1986, 42 U.S.C., Sections 11011 et seq.  

2. Environmental Protection Agency (EPA):  
a. 40 C.F.R. Parts 260, 264, 265, 268, 270  
b. 40 C.F.R. Parts 258 et seq.  
c. 40 C.F.R. Part 761  
d. 40 C.F.R. Parts 122-124  

3. Occupational Safety and Health Administration (OSHA):  
b. OSHA, 29 C.F.R. Part 1926.1101, Construction Standards for Asbestos  
c. OSHA, Lead Exposure in Construction: Interim Final Rule, 29 C.F.R. 1926.62  
e. Asbestos Hazardous Emergency Response Act, Title 40 C.F.R. 763  

4. Department of Transportation:  
a. Title 49 C.F.R. 173.1090  
b. Title 49 C.F.R. 172  
c. Title 49 C.F.R. 173  
d. DOT, HM 181 and MH126f  

C. State of California Requirements:  
1. Statutory Law:  
a. The Carpenter-Presley-Tanner Hazardous Substance Account Act, Health & Safety Code, Sections 25300 et seq.  
b. Health and Safety Code, Section 25359.4  
d. Porter-Cologne Water Quality Control Act, Water Code, Sections 13000 et seq.  
e. Health and Safety Code, Sections 25915-25924  
f. California Labor Code Chapter 6, including, without limitation, Sections 6382, 6501.5-6501.9, 6503.5, 9021.5, 9080  
g. Business and Professions Code, including without limitation, Sections 7058.5, 7065.01, 7118.5  
h. Underground Storage of Hazardous Substance Act, Health and Safety Code, Sections 25280 et seq.  
i. Petroleum Underground Storage Tank Cleanup, Health and Safety Code, Sections 25299.10 et seq.  
k. Above Ground Petroleum Storage Act, Health and Safety Code, Sections 25270 et seq.  

2. Administrative Code and Regulations:
a. Title 22 CCR Division 4.5, Environmental Health Standards for the Management of Hazardous Waste, Sections 6600 et seq.
b. Title 8 CCR, Section 1529, Asbestos
c. Title 8 CCR, Section 1532.1, Lead in Construction
d. Title 23 CCR, Sections 2610 et seq.

3. Local Agency Requirements:
   a. Bay Area Air Quality Management District, Fugitive Dust Rules
   b. Bay Area Air Quality Management District Regulation 11, Rule 2
   c. State Water Resource Control Board, General Construction and Land Disturbance Activities (Order 2009-009 DWQ)

4. Local Agency Requirements:
   a. Contra Costa Fire District
   b. City of Pittsburg, CA

PART 2 - PRODUCTS
Not Used.

PART 3 - EXECUTION
Not Used.

END OF SECTION 01412
SECTION 01414
GUIDELINES FOR OPERATIONS DURING A PROTEST

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”

1.3 SUMMARY
A. Project Security
   1. Project security is the responsibility of the Contractor. However, there may be occasions where campus events elicit a protest response from campus and community constituencies. If protests occur at the Site, the District will attempt to insure a safe work environment for construction activities. If the safety of the Site cannot be assured by the District (both for the construction personnel and for the equipment and materials), the Contractor will be directed to vacate the Site and asked not to return until the Site can be secured.

1.4 PROCEDURES DURING A PROTEST
A. Known Protests (Most Common):
   1. In most cases, protests will be anticipated. Information is provided in advance to the Campus Police Department (CPD), or the assemblage can be seen from the Site.
   2. Under these conditions, CPD will dispatch officers to the Site. CPD will notify the District Representative who will contact the Project Inspector. Once on Site, the supervising CPD officer will introduce himself to the Contractor's Superintendent, the Project Inspector and a review of the situation will be made.
   3. The supervising CPD officer will determine if the Contractor should cease work in certain areas, relocate his work forces, or vacate the premises.
   4. The Project Inspector, and Contractor will document the action in their daily report(s), and consideration shall be given to the Contractor for an extension of contract time only. Any extension of Contract Time will be by an executed Change Order and shall be reviewed and approved by District.

B. Unknown Event:
   1. In the event that protest activities occur without prior notification and consultation with CPD, the Contractor is to cease all work activities that may directly or indirectly cause harm to a worker or protestor.
   2. The Contractor should leave the affected area, and if possible, remove tools, equipment and construction materials. The Contractor’s Superintendent will notify the Project Inspector of
the event.
3. The Project Inspector will record this activity in their daily report) and consideration may be given by District to the Contractor for an extension of Contract Time.

C. If the Contractor is prevented from vacating the affected area by protestors, CPD will attempt to provide safe egress for the Contractor.

D. Under no circumstances is the Contractor to confront protestors, incite activity, or physically impede their intended activity.

E. The Contractor shall be aware of the work area and cognizant of any unusual visitors to the Site.

F. Jurisdiction is as follows:
   On-Campus Events:
   Diablo Valley College Campus Police Department
   Phone: (925) 551-6212

   Off-Campus Events:
   City of San Ramon Police Department (Non-Emergency)
   Phone: (925) 973-2700

   Emergency:
   911

END OF SECTION 01414
SECTION 01415
MITIGATION MONITORING REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Specification Sections shall apply to this Section without limitation.

1.2 SUMMARY

A. This Mitigation Monitoring and Reporting Program (MMRP) was formulated based on the findings of the Initial Study/Mitigated Negative Declaration (IS/MND) prepared for the College Improvement Implementation Project. This MMRP is in compliance with Section 1509 of the CEQA Guidelines, which requires that the Lead Agency “adopt a program for monitoring or reporting of the revisions which it has required in the project and the measures it has imposed to mitigate or avoid significant environmental effects.” The MMRP lists mitigation measures recommended in the IS/MND and identifies mitigation monitoring requirements.

B. The District has attempted to insert these MMRP requirements into the various other Specification Sections that are related to the nature of each mitigation measure. This Section is included to provide a consolidated location for all of the CEQA requirements. Where measures are found in any of the Contract Documents that conflict with these measures, the more stringent measure shall apply.

1. Table 1 presents the mitigation measures identified for the Project. Each mitigation measure is numbered according to the topical section to which it pertains in the IS/MND. As an example, Mitigation measure AIR-1 is the first mitigation measure identified in the IS/MND for the Project.

a. Elements of the MMRP which have been stricken out do not apply to this project.

b. The first column of Table 1 identifies the mitigation measure from the IS/MND.

c. The second column, entitled “Action and Implementation Timing,” describes each mitigation measure.

d. The third column, “Party Responsible for Monitoring,” names the party ultimately responsible for ensuring that the mitigation measures are implemented.

e. The fourth column “Action by Monitor,” outlines the steps for monitoring the action identified in the mitigation measure.

f. The fifth column entitled “Monitoring Timing,” states the time the monitor must ensure that the mitigation measure has been implemented.

g. The last column will be used by the District to ensure that individual mitigation measures have been monitored.
Table 1: Mitigation Monitoring and Reporting Program

<table>
<thead>
<tr>
<th>Recommended Mitigation Measures</th>
<th>Action and Implementation Timing</th>
<th>Party Responsible for Implementing Mitigation</th>
<th>Party Responsible for Monitoring</th>
<th>Action by Monitor</th>
<th>Monitoring Timing</th>
<th>Verification of Compliance Name/Date</th>
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<tbody>
<tr>
<td>AIR-1: Consistent with guidance from the BAAQMD, the District shall require contractors to include emissions control measures in construction specifications for the project. The District shall review the final construction specifications to verify that the requirements have been included prior to beginning grading and excavating activities for the project. The District shall verify via field inspection at least twice during construction that the measures are being implemented. The following actions are required: Idling time of diesel-powered construction equipment shall be limited to 2 minutes; Alternative powered construction equipment (i.e., CNG, biodiesel, electric) shall be utilized when feasible; Add-on control devices shall be used such as diesel oxidation catalysts or particulate filters; Project construction shall be phased; and Operating hours of heavy-duty equipment shall be minimized.</td>
<td>Implement all the emission control measures listed in Mitigation Measure AIR-1 during construction</td>
<td>Contra Costa Community College District and construction contractor</td>
<td>Contra Costa Community College District</td>
<td>1. Review final construction specifications to ensure all requirements listed in Mitigation Measure AIR-1 are included 2. Visit project site at least twice to verify that emission control measures are being implemented</td>
<td>1. Before grading begins 2. During project construction</td>
<td>Name: Date:</td>
</tr>
<tr>
<td>Recommended Mitigation Measures</td>
<td>Action and Implementation Timing</td>
<td>Party Responsible for Implementing Mitigation</td>
<td>Party Responsible for Monitoring</td>
<td>Action by Monitor</td>
<td>Monitoring Timing</td>
<td>Verification of Compliance Name/Date</td>
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<td>AIR-2: Consistent with the guidance from the BAAQMD, the District shall include dust control measures in construction contracts and specifications for the project. The District shall verify via field inspection at least twice during construction of each project that the measures are being implemented. The following measures shall be required: The following controls shall be implemented at all construction sites: Water all active construction areas at least twice daily and more often during windy periods; active areas adjacent to existing land uses shall be kept damp at all times, or shall be treated with non-toxic stabilizers to control dust; Cover all trucks hauling soil, land, and other loose materials or require all trucks to maintain at least two feet of freeboard; Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas, inactive construction areas, and staging areas at construction sites; Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites; water sweepers shall vacuum up excess water to avoid runoff-related impacts to water quality; Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets;</td>
<td>Implement the dust control measures listed in Mitigation Measure AIR-2 during construction</td>
<td>Contra Costa Community College District and construction contractor</td>
<td>Contra Costa Community College District</td>
<td>1. Review final construction specifications to ensure all requirements listed in Mitigation Measure AIR-2 are included</td>
<td>1. Before grading begins</td>
<td>Name: Date:</td>
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<tr>
<td>Recommended Mitigation Measures</td>
<td>Action and Implementation Timing</td>
<td>Party Responsible for Implementing Mitigation</td>
<td>Party Responsible for Monitoring</td>
<td>Action by Monitor</td>
<td>Monitoring Timing</td>
<td>Verification of Compliance Name/Date</td>
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<td>AIR-2 Continued</td>
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<td>Enclose, cover, water twice daily, or apply non-toxic soil binders to exposed stockpiles (dirt, sand, etc.);</td>
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<td>Install base rock at entryways for all existing trucks, and wash off the tires or tracks of all trucks and equipment in designated areas before leaving the site;</td>
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<td>Limit traffic speeds on unpaved roads to 15 mph;</td>
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<td>Install sandbags or other erosion control measures to prevent silt runoff to public roadways;</td>
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<td>Replant vegetation in disturbed areas as quickly as possible; and</td>
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<td>Suspend excavation and grading activity when sustained wind speeds exceed 25 mph. Sustained wind speed shall be determined by averaging observed values over a two-minute period. Wind monitoring by the construction manager shall be required at all times during excavation and grading activities.</td>
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<tr>
<td>AIR-3a: Implement Mitigation Measure AIR-1.</td>
<td>See Mitigation Measure AIR-1</td>
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<td>AIR-3b: Implement Mitigation Measure AIR-2.</td>
<td>See Mitigation Measure AIR-2</td>
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### V. CULTURAL RESOURCES

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<th>Recommended Mitigation Measures</th>
<th>Action and Implementation Timing</th>
<th>Party Responsible for Implementing Mitigation</th>
<th>Party Responsible for Monitoring</th>
<th>Action by Monitor</th>
<th>Monitoring Timing</th>
<th>Verification of Compliance Name/Date</th>
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<td>CULT-1: The District shall inform its contractor(s) of the possibility of encountering archaeological resources during subsurface excavations by including the following directive in contract documents: “If prehistoric or historical archaeological deposits are discovered during project activities, all work within 25 feet of the discovery shall be redirected and a qualified archaeologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations regarding the treatment of the discovery. Project personnel shall not collect or move any archaeological materials or human remains and associated materials. Adverse effects to archaeological deposits shall be avoided by project activities. If such deposits cannot be avoided, they shall be evaluated for their California Register of Historical Resources eligibility.”</td>
<td>1. Include the directive described in Mitigation Measure CULT-1 in contract documents 2. Evaluate any archaeological resources discovered during project construction as described in CULT-1 and submit report of findings to the District and the NWIC</td>
<td>1. Contra Costa Community College District 2. Construction contractor</td>
<td>1. Contra Costa Community College District 2. Contra Costa Community College District</td>
<td>1. Verify that the appropriate language has been incorporated in contract documents 2. Visit project site and verify that measures are being implemented and that any reports are submitted to the NWIC</td>
<td>1. Before grading begins 2. During project construction</td>
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Contra Costa Community College District
Diablo Valley College
D-4002 SRC Expansion Project

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Mitigation Monitoring Regulatory Requirements
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<th>Recommended Mitigation Measures</th>
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<td>The Contra Costa Community College District shall verify that the language has been included in the contract documents. If the deposit is not eligible, a determination shall be made as to whether it qualifies as a “unique archaeological resource” under CEQA. If the deposit is neither a historical nor unique archaeological resource, avoidance is not necessary. If the deposit is eligible for the California Register, or is a unique archaeological resource, adverse effects shall be avoided, or such effects must be mitigated. Mitigation may consist of, but is not necessarily limited to, systematic recovery and analysis of archaeological deposits; creation of a record for the resource; preparation of a report of findings; and an offer of the recovered archaeological materials to an appropriate curation facility. Public educational outreach may also be appropriate. Upon a completion of the assessment, the archaeologist shall prepare a report documenting the assessment methods and results and provide recommendations for the treatment of the archaeological materials discovered. The report shall be submitted to the Contra Costa Community College District and the Northwest Information Center.</td>
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<td>CULT-2: The District shall inform its contractor(s) of the sensitivity of the project area for paleontological resources by including the following directive in contract documents: “The subsurface at the construction site may be sensitive for paleontological resources. If paleontological resources are encountered during project construction, all ground-disturbing activities within 25 feet shall be redirected and a qualified paleontologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. Project personnel shall not collect or move any paleontological materials. Paleontological resources include fossil plants and animals, and such trace fossil evidence of past life as tracks. Ancient marine sediments may contain invertebrate fossils such as snails, clam and oyster shells, sponges, and protozoa; and vertebrate fossils such as fish, whale, and sea lion bones. Vertebrate land mammals may include bones of mammoth, camel, saber tooth cat, horse, and bison. Paleontological resources also include plant imprints, petrified wood, and animal tracks.”</td>
<td>1. Include the directive described in Mitigation Measure CULT-2 in contract documents</td>
<td>1. Contra Costa Community College District</td>
<td>1. Contra Costa Community College District</td>
<td>1. Verify that the appropriate language has been incorporated in contract documents</td>
<td>1. Before grading begins</td>
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<td>2. Evaluate any paleontological resources discovered during project construction as described in CULT-2 and submit report of findings to the District and a paleontological repository</td>
<td>2. Construction contractor</td>
<td>2. Contra Costa Community College District</td>
<td>2. Visit project site and verify that measures are being implemented and that any reports are submitted to a paleontological repository</td>
<td>2. During project construction</td>
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### Recommended Mitigation Measures

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<td>The Contra Costa Community College District shall verify that the language has been included in the contract documents. Adverse effects to such deposits shall be avoided by project activities. If avoidance is not feasible, the paleontological resources shall be evaluated for their significance. Paleontological resources are considered significant if they possess the possibility of providing new information regarding past life forms, paleoecology, stratigraphy, and geological formation processes. If the resources are not significant, avoidance is not necessary. If the resources are significant, project activities shall avoid disturbing the deposits, or the adverse effects of disturbance shall be mitigated. Mitigation may include monitoring, recording the fossil locality, data recovery and analysis, a final report, and accessioning the fossil material and technical report to a paleontological repository. Public educational outreach may also be appropriate. Upon completion of the assessment, a report documenting the assessment methods, findings, and recommendations shall be prepared and submitted to the Contra Costa Community College District, and, if paleontological materials are recovered, a paleontological repository, such as the University of California Museum of Paleontology.</td>
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<td>Recommended Mitigation Measures</td>
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| **CULT-3:** If human remains are encountered, these remains shall be treated in accordance with HSC Section 7050.5. The project applicant shall inform its contractor(s) of the sensitivity of the project area for human remains by including the following directive in contract documents: “If human remains are encountered during project activities, work within 25 feet of the discovery shall be redirected and the County Coroner notified immediately. At the same time, an archaeologist shall be contacted, if an archaeological monitor is not present, to assess the situation and consult with agencies as appropriate. Project personnel shall not collect or move any human remains and associated materials. If the human remains are of Native American origin, the Coroner must notify the Native American Heritage Commission within 24 hours of this identification. The Native American Heritage Commission will identify a Most Likely Descendant to inspect the site and provide recommendations for the proper treatment of the remains and associated grave goods, which may include scientific removal and analysis of human remains and items associated with Native American burials.” | 1. Include the directive described in Mitigation Measure CULT-3 in contract documents 2. Stop work within 25 feet of human remains discovered during project construction; prepare and submit report of findings to the District and NWIC | 1. Contra Costa Community College District 2. Construction contractor | 1. Contra Costa Community College District 2. Contra Costa Community College District | 1. Verify that the appropriate language has been incorporated in contract documents 2. Visit project site and verify that measures are being implemented and that any reports are submitted to NWIC | 1. Before grading begins 2. During project construction | Name:  
Date: |
### Recommended Mitigation Measures

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<td>The Contra Costa Community College District shall verify that the language has been included in the contract documents. Upon completion of the assessment, the archaeologist shall prepare a report documenting the assessment methods and results and provide recommendations for the treatment of the human remains and any associated cultural materials, as appropriate and in coordination with the recommendations of the MLD. The report shall be submitted to the Contra Costa Community College District and the Northwest Information Center.</td>
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<td>VI. GEOLOGY AND SOILS</td>
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<td>GEO-1: Implement Mitigation Measure HYD-1.</td>
<td>See Mitigation Measure HYD-1.</td>
<td>Contra Costa Community College District</td>
<td>Contra Costa Community College District</td>
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<td>Prior to construction</td>
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<td>GEO-2: The District shall incorporate all recommendations of a final site-specific design-level geotechnical investigation, prepared by a licensed professional, into all engineering and construction plans submitted for the project, including recommendations for grading, placement of fill materials, pretreatment of soils, and avoidance of settlement and/or differential settlement of infrastructure and buildings caused by expansive soils and protection of iron, steel, metal and concrete from deterioration caused by contact with corrosive soils.</td>
<td>Incorporate recommendations from geotechnical investigations into development plans</td>
<td>Contra Costa Community College District</td>
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<td>VII. HAZARDS AND HAZARDOUS MATERIALS</td>
<td>Complete a lead-based paint survey as described in Mitigation Measure HAZ-1a</td>
<td>Contra Costa Community College District</td>
<td>Contra Costa Community College District</td>
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<td>Before demolition begins</td>
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<td>HAZ-1a: Prior to demolition of structures on the site, a comprehensive lead-based paint survey shall be conducted. If any lead-based paint is identified, it shall be removed from the site in accordance with all applicable regulations, including Occupational Safety and Health Administration (OSHA) guidelines. The District shall verify that the survey has been conducted before beginning demolition of buildings.</td>
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<td>HAZ-1b: Prior to demolition of structures on the site, a complete Asbestos Hazard Emergency Response Act-Level Pre-Demolition Asbestos Survey shall be conducted. If asbestos is identified, a licensed asbestos abatement contractor shall be retained to abate identified asbestos-containing material in accordance with all applicable regulations. The District shall verify that the survey has been conducted before beginning demolition of buildings.</td>
<td>Complete an asbestos survey as described in Mitigation Measure HAZ-1b</td>
<td>Contra Costa Community College District</td>
<td>Contra Costa Community College District</td>
<td>Verify that the survey has been conducted</td>
<td>Before demolition begins</td>
<td>Name: Date:</td>
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<td>VIII. HYDROLOGY AND WATER QUALITY</td>
<td>HYD-1: The District shall prepare a Storm Water Pollution Prevention Plan (SWPPP) designed to reduce potential impacts to surface water quality through the construction and operational periods of the project including all on- and off-site improvements. The SWPPP shall be prepared by the Facilities Division of the CCCC and submitted to the Division of the State Architect prior to issuance of project approvals. The SWPPP must be maintained on-site and made available to Water Board staff upon request. The SWPPP shall include specific and detailed BMPs designed to mitigate construction-related and operational period pollutants.</td>
<td>Facilities Division of the District shall prepare, and the Division of the State Architect shall approve a SWPPP that includes requirements listed in HYD-1</td>
<td>Contra Costa Community College District</td>
<td>Contra Costa Community College District</td>
<td>Verify that the SWPPP has been prepared</td>
<td>Before construction begins</td>
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### Recommended Mitigation Measures

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*Construction Period:* At a minimum, BMPs shall include practices to minimize the contact of construction materials, equipment, and maintenance supplies (e.g., fuels, lubricants, paints, solvents, adhesives) with stormwater. The SWPPP shall specify properly designed centralized storage areas that keep these materials out of the rain.

An important component of the stormwater quality protection effort is the knowledge of the site supervisors and workers. To educate on-site personnel and maintain awareness of the importance of stormwater quality protection, site supervisors shall conduct regular tailgate meetings to discuss pollution prevention. The frequency of the meetings and required personnel attendance list shall be specified in the SWPPP.

The SWPPP shall specify a monitoring program to be implemented by the construction site supervisor, which must include both dry and wet weather inspections. In addition, in accordance with State Board Resolution No. 2001-046, monitoring would be required during the construction period for pollutants that may be present in the runoff that are “not visually detectable in runoff.” Water Board personnel, who may make unannounced site inspections, are empowered to levy considerable fines if it is determined that the SWPPP has not been properly implemented.
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<td>BMPs designed to reduce erosion of exposed soil may include, but are not limited to soil stabilization controls, watering for dust control, perimeter silt fences, placement of fiber rolls, and sediment basins. The potential for erosion is generally increased if grading is performed during the rainy season as disturbed soil can be exposed to rainfall and storm runoff. If grading must be conducted during the rainy season, the primary BMPs selected shall focus on erosion control; that is, keeping sediment on the site. End-of-pipe sediment control measures (e.g., basins and traps) shall be used only as secondary measures. Entry and egress from the construction site shall be carefully controlled to minimize off-site tracking of sediment. Vehicle and equipment wash-down facilities shall be designed to be accessible and functional during both dry and wet conditions.</td>
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<td><strong>Operational Period:</strong> <em>(Post-Construction Storm Water Management)</em> The SWPPP shall include descriptions of the IMPs or BMPs to reduce pollutants in storm water discharges after all construction phases have been completed at the site <em>(Post-Construction BMPs)</em>. Post-Construction BMPs include the minimization of land disturbance, the minimization of impervious</td>
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<td>HYD-1 Continued surfaces, treatment of storm water runoff using infiltration, detention/retention, bio-filter BMPs, use of efficient irrigation systems, ensuring that interior building drains are not connected to a storm sewer system, and appropriately designed and constructed energy dissipation devices. These must be consistent with all applicable post-construction storm water management requirements, policies, and guidelines. The discharger must consider site-specific and seasonal conditions when designing the control practices. Operation and maintenance of control practices after construction is completed shall be addressed, including short- and long-term funding sources and the responsible party. The SWPPP shall include a discussion of the program to inspect and maintain all BMPs as identified in the site plan or other narrative documents throughout the entire life of the project. A qualified person shall be assigned the responsibility to conduct inspections. Inspections shall be performed before and after storm events and once each 24-hour period during extended storm events to identify BMP effectiveness and implement repairs or design changes as soon as feasible depending upon field conditions. Equipment, materials, and workers must be available for rapid response to failures and emergencies. All corrective maintenance to BMPs shall be performed as soon as possible after the conclusion of each storm depending upon worker safety.</td>
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<td>The SWPPP shall include operational-period BMPs that would result in treatment of an appropriate percentage of the runoff from the project including all on- and off-site improvements. The SWPPP shall include as many LID BMPs as feasible. The Facilities Division of the CCCCD shall prepare and the Division of the State Architect shall approve the SWPPP, including operational period BMPs, prior to approval of the project plans.</td>
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<td><strong>HYD-2: Implement Mitigation Measure HYD-1.</strong></td>
<td>See Mitigation Measure HYD-1.</td>
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<td><strong>HYD-3: Implement Mitigation Measure HYD-1.</strong></td>
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<td><strong>HYD-4: Implement Mitigation Measure HYD-1.</strong></td>
<td>See Mitigation Measure HYD-1.</td>
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<td>XI. NOISE</td>
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<td><strong>NOISE-1:</strong> The project shall implement the following noise reduction measures: The District shall coordinate with the LMC campus administration and the construction contractor to schedule loud construction activities to less sensitive time periods. All heavy construction equipment used on the project site shall be maintained in good operating condition, with all internal combustion, engine-driven equipment fitted with intake and exhaust mufflers that are in good condition.</td>
<td>Implement the noise-reducing measures described in Mitigation Measure NOISE-1</td>
<td>Construction contractor</td>
<td>Contra Costa Community College District</td>
<td>Visit project site and verify that noise control measures are being implemented</td>
<td>During project construction</td>
<td>Name: Date:</td>
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**PART 2 – PRODUCTS** - Not Used.

**PART 3 – EXECUTION** - Not Used.
SECTION 01416
SPECIAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
   A. Section 01010 – “Summary of Work”
   B. Section 01290 – “Payment Procedures”
   C. Section 01330 – “Submittal Procedures”
   D. Section 01740 – “Warranties and Guaranties”
   E. Section 01780 – “Project Record Documents”
   F. Section 01820 – “Demonstration and Training”
   G. Divisions 2 through 33 Sections for Contract Closeout Procedure requirements for the work in those Sections.

1.3 SUMMARY
   A. In Compliance with CEQA requirements, the District conducted an Initial Study to ascertain if the project may have an effect on the environment. The Initial Study identified potential impacts on the environment. However, all potential impacts of the proposed Project can be avoided or reduced to a less-than-significant level by implementation of the following mitigation measures. Contractor shall conform with the following mitigation measures, including but not limited to, the following:
      1. Noise Control Plan
      2. Dust Control Plan
      3. Traffic Control Plan
      4. Spill Prevention, Control and Countermeasure Program
      5. Tree Protection Plan
      6. Migratory Bird Protection Plan
      7. Cultural Resources Protection Plan
   B. In no case shall the restrictions identified in this Section limit the Contractor’s responsibility for compliance with all Federal, state, and local safety ordinances and regulations.

1.4 NOISE CONTROL
   A. Definitions
1. **Noise** is any audible sound which has the potential to annoy or disturb humans, or to cause an adverse psychological or physiological effect on humans.

2. **Daytime** refers to the period from 7 AM to 7 PM local time daily, except Sundays and Federal holidays.

3. **Evening** refers to the period from 7 PM to 10 PM local time daily, except Sundays and Federal holidays.

4. **Nighttime** refers to the period from 10 PM to 7 AM local time daily, as well as all day Sunday and Federal holidays.

5. **Nuisance Noise** refers to sound levels that annoy or disturb a reasonable person of normal sensitivities, but do not exceed the noise limits specified herein.

6. **Lot-line** refers to the line separating the campus from another parcel or from the street.

7. **Background Noise** shall be defined as the measured ambient noise level associated with all existing environmental, transportation, and community noise sources in the absence of any audible construction activity.

8. **dBA** shall be defined as the sound level (in decibels referenced to 20 micro-pascals) as measured using the A-weighting network on a sound level meter, in accordance with ANSI S1.4 Standards.

9. **Lmax** shall be defined as the maximum measured sound level at any instant in time.

10. **Leq** shall be defined as the equivalent sound level, or the continuous sound level that represents the same sound energy as the varying sound levels, over a specified monitoring period.

11. **L10** shall be defined as the sound level exceeded 10 percent of the time for a specified monitoring period.

12. **Slow** specifies a time constant or 1 second for the root-mean-square (RMS) detector used by a sound level meter, in accordance with ANSI S1.4 Standards.

13. **Impact noise** is noise produced from impact or devices with discernible separation in sound pressure maxima. Examples for impact equipment include, but are not limited to; blasting, clam shovel or chisel drops, pavement breakers, jackhammers, hoe rams, mounted impact hammers, and impact pile drivers (but not vibratory pile drivers).

B. The intent of this Section is to minimize construction noise within construction areas, lay-down areas, and communities adjacent to the construction site. To this end, the Contractor and all subcontractors, suppliers, and vendors, are required to comply with all applicable noise regulations, specification requirements, and the noise level limits specified herein.

C. The Contractor shall use equipment with efficient noise-suppression devices and employ other noise abatement measures such as enclosures and barriers necessary for the protection of the public, as necessary.

D. The Contractor shall schedule and conduct operations in a manner that will minimize, to the greatest extent feasible, the disturbance to the public in areas adjacent to the Work and to occupants of buildings in the vicinity of the Work.

E. After the Preconstruction Meeting and prior to the commencement of the Work at the Site, Contractor shall submit a Noise Control and Monitoring Plan for review and acceptance by the District.
1. The Noise Control and Monitoring Plan shall describe the noise monitoring and reporting procedure to be used during construction, the procedures for predicting construction noise levels prior to performing construction activities and describe the noise reduction measures required to meet the noise level limitations and minimize nuisance noise conditions. Noise generating equipment shall not be operated prior to acceptance of the Noise Control and Monitoring Plan.

2. The Noise Control and Monitoring Plan shall identify and describe the following in detail:
   a. The receptor locations where noise monitoring will be performed. Include a site plan showing all locations.
   b. The type of noise level measurement device that will be used.
   c. The noise monitoring methods and procedures that will be used.
   d. The data reporting method that will be used.
   e. The response procedure and actions to be taken by the Contractor for any lot-line, educational facility, or equipment noise level that exceeds the noise limits specified in this Section. The response procedure may include, but not be limited to, use of additional noise reduction materials and equipment.
   f. The noise complaint response and resolution procedures.
   g. A description of the anticipated significant noise generating construction activities.
   h. An inventory of construction equipment to be utilized and the associated noise levels for each.

F. Submit a current laboratory calibration conformance certificate for the noise monitoring equipment to be used prior to performing any noise level monitoring. Submit updated certificates following subsequent yearly calibrations, or upon completion of repairs to the instrument, for the duration of this Contract.

G. Noise Control Measures: Contractor shall implement the following noise-control measures to reduce and control noise generated from construction, demolition, and construction related activities:

1. Restrict noise-producing construction activities to between 7:00 a.m. and 7:00 p.m. on weekdays. If construction is scheduled for Saturdays or Sundays to avoid disrupting college operations, restrict noise-producing construction activities to between 9:00 a.m. and 5:00 p.m. Construction on Sundays shall be avoided, if possible, and there will be no construction on public holidays without prior written request submitted to and written approval returned by the District, at its sole discretion. A decision by the District to deny Sunday or holiday work shall not be deemed to cause a delay in the Contract Time. When activities must occur outside the hours specified above, conform with notification requirements of this Section and utilize local barriers around equipment and other noise attenuating devices if necessary to limit noise to acceptable levels.

2. Comply with all City of San Ramon requirements regarding both allowable hours of Work and noise level limitations.

3. Contractor shall comply with applicable regulatory requirements for the operation of powered construction equipment during all phases of construction.
4. All construction equipment shall have appropriate mufflers, intake silencers, and other required noise-control features, shall be properly maintained and in compliance with State standards.

5. Vehicles and other gas or diesel-powered equipment shall be prohibited from unnecessary warming up, idling, and engine revving.

6. Impact tools shall utilize “quiet technology” to minimize noise.

7. Contractor shall provide and post signs at the Site giving the name and telephone number or e-mail address of the District and/or designated College Representative whom the public should contact regarding any noise complaints. If necessary due to complaints, Contractor shall provide additional noise-attenuating measures such as additional mufflers or engine shrouding.

H. Secure written permission from the District at least three (3) working days prior to using noisy and vibratory equipment, such as jackhammers, concrete saws, impact tools, and high frequency electrical equipment. Cooperate with District if the use of noisy equipment becomes objectionable to college employees and/or students

I. The work must be conducted so that nearby residents and college operations in surrounding facilities and classrooms will not be disturbed at any time during the Work including, but not limited to, the following requirements:

1. The Contractor shall perform all work within the permissible noise levels, day of week, or weekend and hour of day limitations, and within the guidelines established by applicable federal, state, and municipal codes, regulations, laws, and standards.

2. During the Work, the Contractor shall ensure that all noise generated from construction-related equipment and construction activity complies with applicable Contra Costa County and City of San Ramon noise standards and thresholds where technically feasible. Noise standards and thresholds of Contra Costa County and City of San Ramon are therefore included, by reference, in the Contractor’s contract.

3. In the event of complaints from nearby residents or the campus community, the Contractor shall measure noise levels at both adjacent residential lot lines and nearby educational buildings. In the event that construction noise exceeds the specified limits, the responsible construction activity shall cease until appropriate noise control measures are implemented. In the event that the measured noise level exceeds allowable limits as specified in this Section, or is resulting in nuisance conditions, the Contractor shall immediately alter operations or use noise reduction materials and methods to reduce noise levels or to alleviate the nuisance conditions.

4. Do not use loud vocal or mechanical signals. Use of outside speakers, loud radios and similar devices are prohibited.

5. Exterior noise levels shall not exceed the Noise Level and Duration Standards specified herein.

6. Work shall be performed in a manner to prevent nuisance conditions such as noise which exhibits a specific audible frequency or tone (e.g., backup alarms, poorly maintained equipment, brake squeal, etc.) or impact noise (e.g., jackhammers, hoe rams). The District will make any final interpretation concerning whether or not nuisance noise conditions exist. Only the District representatives and specifically designated College representatives
have the authority to stop the Work until nuisance noise conditions are resolved, without additional Contract Time or compensation for the Contractor.

1.5 **NOISE MONITORING EQUIPMENT**

A. All noise measurements shall be performed with an instrument that is in compliance with the criteria for a Type 1 (Precision) or Type 2 (General Purpose) Sound Level Meter as defined in the current revision of ANSI Standard S1.4.

B. The sound level meter shall be capable of measuring dBA noise levels and operating on the “slow” response setting.

C. Sound level meters shall be capable of measuring and displaying $L_{max}$ and $L_{10}$ over 20-minute intervals in the field without the need for post-processing of data.

D. All sound level meters, microphones, and calibrators shall undergo certified laboratory calibration conformance testing at least once a year. The calibration certificate shall be submitted to the District.

E. The sound level meter shall be on the Site and readily accessible at all times.

1.6 **NOISE LEVELS AND DURATION STANDARD**

A. Contractor shall comply with the following noise level standards:

1. Only the transport of construction equipment on the Site may occur outside of regular construction hours. Construction equipment shall be properly outfitted and maintained to ensure that noise reduction is maximized.

2. The Tables below defines the permissible for Noise Level and Duration Standards for this Project:

<table>
<thead>
<tr>
<th>Max. Cumulative Duration of Noise Event in Any One-hour Period</th>
<th>Exterior Noise Level Standards, dBA, $L_{eq}$ 7AM to 10PM</th>
<th>Exterior Noise Level Standards, dBA, $L_{eq}$ 10 PM to 7 AM</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 minutes</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>15 minutes</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>5 minutes</td>
<td>60</td>
<td>55</td>
</tr>
<tr>
<td>1 minute</td>
<td>65</td>
<td>60</td>
</tr>
<tr>
<td>0 minutes</td>
<td>70</td>
<td>65</td>
</tr>
</tbody>
</table>

**TABLE 2: PERMISSIBLE NOISE LEVELS AT BUILDINGS ADJACENT TO PROJECT SITE**
<table>
<thead>
<tr>
<th>Max. Cumulative Duration of Noise Event in Any One-hour Period</th>
<th>Exterior Noise Level Standards, dB(A), Leq 7AM to 10PM</th>
<th>Exterior Noise Level Standards, dB(A), Leq 10 PM to 7 AM</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 minutes</td>
<td>70</td>
<td>See Table 1</td>
</tr>
<tr>
<td>15 minutes</td>
<td>75</td>
<td>See Table 1</td>
</tr>
<tr>
<td>5 minutes</td>
<td>80</td>
<td>See Table 1</td>
</tr>
<tr>
<td>1 minute</td>
<td>85</td>
<td>See Table 1</td>
</tr>
<tr>
<td>0 minutes</td>
<td>90</td>
<td>See Table 1</td>
</tr>
</tbody>
</table>

B. Equipment and associated equipment operating under full load shall not exceed the Lmax noise limits specified in Table 3, below. The 50-foot noise emission limits specified in Table 3 shall apply to the entire operation in which the equipment is engaged. Table 3 also provides distinction as to which equipment is considered to emit impact or continuous noise.
Table 3: Lmax Noise Limits

<table>
<thead>
<tr>
<th>Equipment Category</th>
<th>Lmax Noise Limit at 50 ft, dBA, slow</th>
<th>Is Equipment an Impact Device? (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All other equipment &gt; 5 HP</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Auger Drill Rig</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Backhoe</td>
<td>80</td>
<td>No</td>
</tr>
<tr>
<td>Bar Bender</td>
<td>80</td>
<td>No</td>
</tr>
<tr>
<td>Boring Jack Power Unit</td>
<td>80</td>
<td>No</td>
</tr>
<tr>
<td>Chain Saw</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Clam Shovel</td>
<td>93</td>
<td>Yes</td>
</tr>
<tr>
<td>Compactor (ground d)</td>
<td>80</td>
<td>No</td>
</tr>
<tr>
<td>Compressor (air)</td>
<td>80</td>
<td>No</td>
</tr>
<tr>
<td>Concrete Mixer Truck</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Concrete Pump</td>
<td>82</td>
<td>No</td>
</tr>
<tr>
<td>Concrete Saw</td>
<td>90</td>
<td>No</td>
</tr>
<tr>
<td>Crane (mobile or stationary)</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Dozer</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Dump Truck</td>
<td>84</td>
<td>No</td>
</tr>
<tr>
<td>Excavator</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Flat Bed Truck</td>
<td>84</td>
<td>No</td>
</tr>
<tr>
<td>Front End Loader</td>
<td>80</td>
<td>No</td>
</tr>
<tr>
<td>Generator (25 KVA or less)</td>
<td>70</td>
<td>No</td>
</tr>
<tr>
<td>Generator (more than 25 KVA)</td>
<td>82</td>
<td>No</td>
</tr>
<tr>
<td>Gradall</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Grader</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Horizontal Boring Hydraulic Jack</td>
<td>80</td>
<td>No</td>
</tr>
<tr>
<td>Hydra Break Ram</td>
<td>90</td>
<td>Yes</td>
</tr>
<tr>
<td>Insitu Soil Sampling Rig</td>
<td>84</td>
<td>No</td>
</tr>
<tr>
<td>Jackhammer</td>
<td>85</td>
<td>Yes</td>
</tr>
<tr>
<td>Mounted Impact Hammer (hoe ram)</td>
<td>90</td>
<td>Yes</td>
</tr>
<tr>
<td>Paver</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Pickup Truck</td>
<td>55</td>
<td>No</td>
</tr>
<tr>
<td>Pneumatic Tools</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Pumps</td>
<td>77</td>
<td>No</td>
</tr>
<tr>
<td>Rock Drill</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Scraper</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Tractor</td>
<td>84</td>
<td>No</td>
</tr>
<tr>
<td>Vacuum Excavator (vac-truck)</td>
<td>85</td>
<td>No</td>
</tr>
<tr>
<td>Vacuum Street Sweeper</td>
<td>80</td>
<td>No</td>
</tr>
<tr>
<td>Vibratory Concrete Mixer</td>
<td>80</td>
<td>No</td>
</tr>
<tr>
<td>Welder</td>
<td>73</td>
<td>No</td>
</tr>
</tbody>
</table>

C. See Section 01010 Summary of Work for required non-work days and quiet times.

1.7 DUST CONTROL PLAN

A. Contractor shall develop and submit, in accordance with Section 01330, a Dust Control Plan, and implement dust control measures to protect air quality during construction to control dust
emissions generated during construction, implement the following Bay Area Air Quality Management District (BAAQMD) measures for construction emissions of particulate matter over 10 microns in size (PM10):

1. Water all active construction areas at least twice daily.
2. Cover all trucks hauling soil, sand and other loose materials, or require all trucks to maintain at least 2 feet of freeboard.
3. Apply water three times daily or apply (nontoxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at the Site.
4. Sweep driveways and adjacent public streets daily (with water sweepers) if visible soil materials have been carried onto adjacent public streets.
5. Suspend excavation and grading activity when winds (instantaneous gusts) exceed 25 miles per hour.
6. Limit speed of vehicles to 10 miles per hour or less on the Site.
7. If Campus or neighborhood complaints regarding objectionable dust are received by the College, the Contractor shall take immediately action to abate such conditions.

1.8 TRAFFIC CONTROL PLAN

A. Contractor shall develop and submit a Traffic Control Plan and implement the traffic control plan to minimize the effects of construction traffic on the Campus and surrounding residential areas, as appropriate. Submit the plan in accordance with Section 01330 to the District for review and approval.

B. The Construction traffic control plan will include, at a minimum, the following requirements:

1. Provide clearly marked pedestrian detours if any sidewalk or pedestrian walkway closures are necessary. Provide clear directional signage as required.
2. Provide clearly marked bicycle detours if bicycle routes must be closed, or if bicyclist safety would be otherwise compromised. Provide clear signage as required.
3. Provide crossing guards and/or flag persons as needed to avoid traffic conflicts and ensure both pedestrian and bicyclist safety at all times.
4. Use nonskid traffic plates over open trenches to minimize hazard.
5. Locate all stationary equipment as far away as possible from areas used heavily by vehicles, bicyclists and pedestrians.
6. Notify and consult with emergency service providers, including the Campus Police Department, and maintain clear, unobstructed access by whatever means necessary to expedite and facilitate the passage of emergency vehicles.
7. Obtain City of San Ramon approval for preferred construction traffic routing over public streets, location of temporary curb cuts, if any, and/or other construction traffic access and egress from public streets to the Site. Consult with District concerning preferred construction traffic routing prior to requesting City approval. Contractor shall be responsible for obtaining any required permits and for all associated costs.
8. Avoid routing construction traffic through residential areas to the extent feasible. Prohibit mobilization and demobilization of heavy construction equipment during AM and PM peak traffic hours, and pursuant to City of San Ramon requirements.
9. Provide access for drive ways and private roads outside the immediate construction zone by using steel plates or temporary backfill as necessary.

10. Prohibit construction worker parking in student parking lots and in residential areas.

C. Contractor shall notify the District, Project Inspector, Campus Police Department, city and county agencies, as applicable, a minimum of five (5) working days in advance of performing work which necessitates closing or interfering with traffic on public thoroughfares, parking areas, driveways and walks. Obtain written permission prior to effecting such closures and interruptions.

D. The District will designate an entrance to the Site for the Contractor’s use for the Work.

1.9 SPILL PREVENTION, CONTROL AND COUNTERMEASURE PROGRAM

A. Contractor shall prepare and implement a Spill Prevention, Control and Countermeasure Program (SPCCP) to minimize the potential for and effects from spills of hazardous, toxic or petroleum substances during construction and demolition activities. Submit a SPCCP Plan to the District in accordance with Section 01330 and obtain approval of the SPCCP before any construction or demolition activities begin at the Site.

B. Contractor shall routinely inspect the construction area to verify that the measures specified in the SPCCP are properly implemented and maintained. Inform the District immediately if there is a noncompliance issue and take immediate measures to restore compliance.

C. The federal reportable spill quantity for petroleum products, as defined in 40 CFR 110, is any oil spill that includes any of the following:
   1. Violates applicable water quality standards.
   2. Causes a film or sheen on or discoloration of the water surface or adjoining shoreline.
   3. Causes a sludge or emulsion to be deposited beneath the surface of the water or adjoining shorelines.

D. If a spill is reportable, notify the District’s Representative and take action to contact appropriate safety and clean-up crews to ensure that the SPCCP is followed.
   1. A written description of reportable releases must be submitted to the District’s Representative and to the San Francisco Bay Regional Water Quality Control Board (RWQCB). This submittal must contain a description of the spill, including the type of material and an estimate of the amount spilled, the date of the release, an explanation of why the spill occurred and a description of the steps taken to prevent and control future releases. Document the releases on a spill report form.
   2. If a reportable spill has occurred and results determine that project activities have adversely affected surface water or groundwater quality, the District will engage a registered environmental assessor at Contractor’s expense for a detailed analysis to identify the likely cause of contamination. This analysis will conform to American Society for Testing and Materials (ASTM) standards and will include recommendations for reducing or eliminating the source or mechanisms of contamination.
   3. Based on this analysis, the Contractor shall select and implement measures to control contamination, with a performance standard that groundwater quality must be returned to baseline conditions. These measures will be subject to approval by the District.
1.10 TREE PROTECTION PLAN

A. Develop and submit a Tree Protection Plan to the District in accordance with Section 01330 and obtain approval prior to Start or Work on site. The plan shall include full-size drawings of the Site and indicate all trees that may be impacted by the Work, and all trees that will require proactive protection from damage. Protective measures must be indicated in the plan and on the Drawings.

B. Definitions:
   1. Dripline: The area on the ground from the trunk of any tree to the point directly below the outermost tips of the foliage of that tree.
   2. Root Protection Zone ("RPZ"): The areas enclosed with tree protection fencing as designated on the Drawing(s).
   3. Tree damage: Tree damage shall include, but not limited to, the following: Significant injury to the root system or other parts of a tree including burning, application of toxic substances, damaging through contact with equipment or machinery, changing the natural grade within the Dripline or RPZ, compacting the soil within the Dripline or RPZ, interfering with the normal water requirements of the tree, unauthorized trenching or excavating within the Dripline or RPZ, or unauthorized removal of more than 1/3 of the live wood, foliage or roots.

C. Root Protection: No storage of materials or equipment will be allowed within the Dripline. Whenever possible, excavation shall be on a radial line, diverging from the tree trunk. For items of Work delayed materially beyond the date of Substantial Completion, provide update submittal within 14 Days after acceptance, listing date of acceptance as start of warranty period.

D. Exposure to harmful substances: No storage or dumping of any substances that may be harmful to trees shall occur at any location on the Site.

E. Where construction is to be performed in the vicinity of trees and shrubbery, the Work shall be carried on in a manner that will cause minimum damage. District will designate trees that are to be removed. Under no circumstances are additional trees to be removed without written permission from District. Trees and shrubbery that are not to be removed shall be protected from injury or damage resulting from Contractor’s operations.

F. Any tree that is removed without District’s permission or is irreparably damaged, in the opinion of District, shall cost Contractor in damages [$100.00] per square inch of cross section, measured at 4 ½ feet above ground, but not less than [$250.00], such cost to be deducted from monies due or to become due under the Contract. If tree protection is not performed or is not performed adequately and District determines that a tree has been irreparably damaged, Contractor shall pay the same amount of damages as for unauthorized removal of a tree. Contractor shall immediately report all tree damage to District, so that District may determine applicable damages.

1.11 MIGRATORY BIRD PROTECTION

A. Conduct tree removal and building demolition outside of the migratory bird nesting season. The bird nesting season for migratory birds in this part of California is March 1st through July 31. See Section 01415, Table 1, Section IV, Biological Resources for more information on the bird nesting season.
B. If tree removal or building demolition must take place during the bird nesting season, these activities shall be preceded by a survey paid for by the District for nesting migratory birds by a certified Wildlife Biologist in the State of California. If bird nests are discovered in the trees or on the buildings, they shall not be removed while the nest(s) are active. Contractor shall plan and schedule to remove all trees and buildings during the non-bird nesting season, which is between August 1st and February 28th each year to avoid the need for such activities during the bird nesting season. Any delays as result of tree or building removal that could not occur during the bird nesting season due to active nests are the responsibility of the Contractor if said delays were within the control of the Contractor by performing the work in the non-bird nesting season. (ADD. E)

1.12 CULTURAL RESOURCES PROTECTION PLAN

A. Develop and submit a Cultural Resources Protection Plan in accordance with Section 01330. If buried cultural resources, such as chipped or ground stone, historic debris, building foundations or human bones or paleontological resources are discovered inadvertently during ground-disturbing activities, Contractor shall avoid any further disturbance of the materials and immediately discontinue earthwork within 100 feet of the find. Contractor shall notify District’s Representative immediately upon encountering cultural resources. Contractor shall be prepared to move on to another location or phase of work, allowing sufficient time for District’s Representative to evaluate the nature and significance of the find and implement appropriate management procedures.

B. In the event that prehistoric human remains are encountered, further excavation or disturbance of the site shall cease immediately, pursuant to Health and Safety Code 7050.5. Contractor shall notify District’s Representative immediately upon encountering human remains. Contractor shall move on to another location or phase of work to allow proper assessment of the situation.

C. If human remains of Native American origin are discovered during construction, it will be necessary to comply with State laws relating to the disposition of Native American burials, which fall under the jurisdiction of the NAHC (Public Resources Code (PRC) Section 5097. Consequently, if any human remains are discovered or recognized in any location other than a dedicated cemetery, there will be no further excavation or disturbance of the site or any nearby areas reasonably suspected to overlie adjacent human remains:

1. Until the Contra Costa County Coroner has been informed and has determined that no investigation of the cause of death is required;

2. If the remains are of Native American origin;
   a. The descendants of the deceased Native American(s) have made a recommendation to the landowner or the person responsible for the excavation work regarding means of treating or disposing of, with appropriate dignity, the human remains, and any associated grave goods as provided in PRC Section 5097.98 or
   b. The NAHC has been unable to identify a descendent or the descendent failed to make a recommendation within 24 hours after being notified by the NAHC.

PART 2 - PRODUCTS

Not Used.
PART 3 - EXECUTION
Not Used.

END OF SECTION 01416
SECTION 01420
REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in
this document, and provisions in the General Conditions and other Division 1 Specification
Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01312 – “Project Meetings”
C. Section 01410 – “Regulatory Requirements”
D. Section 01770 – “Contract Closeout Procedures”
E. Division 2 through 33 for References requirements for the work in those Sections.

1.3 INDUSTRY STANDARDS
A. Applicability of Standards: Unless the Contract Documents specify more stringent
requirements, applicable construction industry standards have the same force and effect as if
bound or copied directly into the Contract Documents to the extent referenced. Such standards
are made a part of the Contract Documents by reference.
B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless
otherwise indicated.
C. Conflicting Requirements: If compliance with two or more standards is specified and the
standards establish different or conflicting requirements for minimum quantities or quality
levels, comply with the most stringent requirement. Refer uncertainties and requirements that
are different, but apparently equal, to Architect for a decision before proceeding.
1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall
be the minimum provided or performed. The actual installation may comply exactly with
the minimum quantity or quality specified, or it may exceed the minimum within
reasonable limits. To comply with these requirements, indicated numeric values are
minimum or maximum, as appropriate, for the context of requirements. Refer
uncertainties to Architect for a decision before proceeding.
D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with
industry standards applicable to its construction activity. Copies of applicable standards are not
contained within the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain
copies directly from publication source and make them available on request.
E. Abbreviations and Acronyms for Industry Organizations: Where abbreviations and acronyms
are used in Specifications or other Contract Documents, they shall mean the recognized name
of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

F. Abbreviations and Acronyms for Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.

H. Abbreviations and Acronyms for Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.

I. Abbreviations and Acronyms for State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.

PART 2 - PRODUCTS
Not Used.

PART 3 - EXECUTION
Not Used.

END OF SECTION 01420
SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01140 – “Work Restrictions”
C. Section 01311 – “Project Management and Coordination”
D. Section 01412 – “Hazardous Material”
E. Section 01416 – “Special Procedures”
F. Section 01505 – “Construction Waste Management”
G. Section 01572 – “Storm Water Pollution Prevention Plan”
H. Section 01710 – “Cleaning Requirements”
I. Section 01770 – “Contract Closeout Procedures”
J. Divisions 2 through 33 Sections for specific requirements for Temporary Facilities and Controls for the Work in those Sections.

1.3 TEMPORARY FACILITIES AND CONTROLS PLANS
A. Prior to the start of Work at the Site, Contractor shall provide full size drawings of the site plan, illustrating the following:
   1. Locations and dimensions of temporary facilities including, but not limited to, all site trailers. Include floor plan layouts and pertinent details.
   2. Equipment and material storage areas.
   3. Pedestrian access paths and crossings,
   4. Location of way finding and other signage,
   5. Contractor haul routes and avenues of ingress/egress to and within the Campus.
   6. All fenced area and details of the fence installation.
   7. Identify any areas which may have to be paved or graveled to control dust or prevent tracking of mud.
   8. Other items including locations of safety and construction fences and/or barriers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.
B. Contractor shall submit to District (7) sets of Temporary Facilities and Control Plans for review by District and Architect.

C. Contractor shall not perform any work at the Site until said site plan submitted by the Contractor has been accepted in writing by the District.

1.4 REQUIRED TEMPORARY FACILITIES AND CONTROLS

A. Contractor shall provide and maintain all temporary facilities, utilities, and controls as required to perform the Work and as required herein. Materials, installation, and maintenance of temporary utilities and facilities shall be in compliance with all applicable local and State regulatory requirements. Remove temporary utilities and facilities, including associated materials and equipment, when no longer required. Restore and recondition existing facilities used during construction and areas of the Site, roads, driveways, parking lots, landscaping, and any other existing improvements either damaged or disturbed by the installation of temporary facilities or utilities to their original condition. Remove and properly dispose of debris resulting from removal and reconditioning operations.

B. Contractor shall furnish and install requirements for temporary utilities, facilities, security, and protection which include but are not limited to the following:

1. Temporary Electric Power and Lighting
   a. The installation and removal of all temporary distributions of power throughout the Site shall be the sole responsibility of the Contractor without adjustment to the Contract Price or the Contract Time. The Contract Price shall not be adjusted on account of any disruption, reduction or elimination of electrical power service to the Site. Contractor shall provide power outlets for construction operations, with branch wiring and distribution boxes located as required to complete the Work.
   b. Contractor shall provide and maintain electrical power at the Site for construction purposes, for temporary facilities and trailers, and for any other site offices or trailers required by the Contract Documents. Contractor shall provide all necessary wiring and appurtenances.
   c. Contractor shall provide and maintain distribution of temporary electrical power and lighting to the Work and for use by the District project manager and project inspector.
   d. Contractor shall provide temporary power main service disconnect and over current protection at convenient locations and as required by governing codes.
   e. The Contractor shall be responsible for providing temporary facilities as required to deliver power service from the point of connection to the point(s) of intended use.
   f. The Contractor shall provide, install, and maintain temporary electrical lighting wherever necessary to provide illumination for the proper performance and/or observation of the Work. Where required, a minimum of 20 foot-candles for rough work and 50 foot-candles for finish work shall be provided.

2. Temporary Communications/Telephone
   a. Contractor shall provide, maintain, and pay for all required communications and data services (including without limitation telephone, e-mail and internet) to all Project field offices to include a multi-function printer, copier, scanner, fax unit commencing at the
time of Project mobilization, including all installation, connection, and monthly charges. The installation and removal of all temporary telephone and data distribution shall be the sole responsibility of the Contractor without adjustment of the Contract Price or the Contract Time.

b. Contractor shall provide, maintain, pay for telephone and data/internet service to field offices at time of project mobilization and for the duration of the project. Contractor to pay costs for telephone installation, telephones, internet access, maintenance services and removal.

c. Coin operated phones are not acceptable.

d. Contractor to provide a list of important telephone numbers at each telephone on the site offices including, but not limited to the following:
   i) Police and Fire Departments
   ii) Campus Police
   iii) Ambulance Service
   iv) Contractor’s home office
   v) All Principal Subcontractors’ field and home offices
   vi) Architect’s office
   vii) Engineer’s office
   viii) District office
   ix) Project Manager
   x) Project Inspector
   xi) Campus Building & Grounds Department
   xii) Testing Laboratory

e. Provide Contractor superintendent with cellular telephone for use when away from field office.

3. Temporary Water

   a. The Contractor shall be responsible for providing all temporary facilities required to deliver water.

   b. Water shall be provided for dust control, street cleaning, cleaning tools, or vehicle washing. Water used for such purposes shall be provided by the Contractor at its expense.

   c. Contractor shall provide and maintain necessary temporary water supply connections, pipes, hoses, nozzles, and fittings required. Before final acceptance, all temporary water supply components installed by Contractor shall be removed in a manner approved by District’s Representative.

   d. Unnecessary waste of water will not be permitted. Special hydrant wrenches shall be used for opening and closing fire hydrants, and in no case shall pipe wrenches be used.
for this purpose. Obtain approval of governing agency prior to opening any fire hydrant.

e. Contractor shall provide and use backflow preventers on water lines at point of connection to any District water supply. Backflow preventers shall comply with requirements of California Uniform Plumbing Code. The installation and removal of all temporary backflow preventers on the Site shall be the sole responsibility of the Contractor without any adjustment to either the Contract Price or the Contract Time. Before final acceptance, all temporary connections and piping installed by Contractor shall be removed in a manner approved by District’s Representative.

f. Contractor shall provide and make potable water available for human consumption. Contractor shall provide and maintain suitable quality water service required for construction operations.

4. Temporary Fences

a. Temporary Fencing: Contractor shall provide temporary fencing around specified construction areas for safety and protection. Provide chain link fencing not less than six (6) feet in height, complete with metal posts and required bracing, anchorage, visual screening (green fabric), and with truck and pedestrian gates. All vehicle and Pedestrian gates and openings shall have gates secured after hours of operation.

b. Contractor shall provide padlocks used for securing all gates. Padlocks shall be designed to prohibit cutting of shackle. Contractor shall coordinate keying strategy with District.

c. Contractor shall be responsible for locking gates and shall be secured with minimum 3/8 inch thick, 30 grade coil chain, minimum 5/16 inch cable. Gates shall be kept closed and locked at all times when not in use.

d. All existing fences affected by the Work shall be maintained by Contractor until Final Completion of Project. Fences which interfere with construction operations shall not be relocated or dismantled until District gives written permission to do so, and the timing of fence relocation or dismantling has been agreed upon. Where fences must be maintained across the construction easement, adequate gates shall be installed. Site Enclosure Fence: Contractor shall furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gate.

e. Contractor will be responsible for maintaining security by limiting number of keys and restricting distribution to authorized personnel.

f. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft and similar violation of security.

g. Contractor shall provide secure lockup for stored materials and equipment which are of value or attractive for theft.

h. Contractor shall be responsible for project security for materials, tools, equipment, supplies and completed and partially completed Work.
i. On completion of the Work across any tract of land, Contractor shall restore all fences to their original or to a better condition, and to their original locations.

5. **Temporary Protection of Public and Private Property**
   a. Contractor shall protect, shore, brace, support and maintain all existing underground utilities including but not limited to the following: all pipes, conduits, drains and other underground construction uncovered or otherwise affected by construction operations.
   b. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences and other surfaces structures affected by construction operations, together with all sod and shrubs in yards, planting areas, and medians, shall be restored to their original condition, wherever affected by construction operations. All replacements shall be made with new materials.
   c. Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or workers to or from the Work, Site or any part thereof, whether by Contractor or Subcontractors. Contractor shall be solely responsible without adjustment of the Contract Price or the Contract Time to make satisfactory and acceptable arrangements with the District, or the agency or authority having jurisdiction over the damaged property, concerning its repair or replacement or payment of costs incurred in connection with the damage.
   d. All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

6. **Temporary Sanitary Facilities**
   a. Contractor shall provide and maintain temporary sanitary toilets for use of all workers throughout the course of the Work. At a minimum, sanitary facilities shall be located at the trailer site, Contractor staging area(s) and adjacent to Work areas.
   b. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the Project, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least (1) toilet will be furnished for each (15) persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the Site.
   c. Contractor shall comply with all minimum requirements of the Contra Costa Health Department or other public agency having jurisdiction.
   d. Maintain temporary facilities in a sanitary condition at all times during the Project.
   e. Contractor will keep sanitary facilities free from graffiti.
   f. Use of toilet facilities installed as part of the Work shall not be permitted.
   g. Contractor is not permitted to use existing campus toilet facilities
   h. All Portable toilets shall be located within fenced areas of the Site.
   i. Contractor shall be responsible for providing access to the temporary toilet facilities.
7. **Temporary Barriers and Enclosures**
   a. Contractor shall provide barriers to prevent unauthorized entry to construction areas to allow for District’s use of the Site, and to protect existing facilities and adjacent improvements from damage during construction operations.
   b. Contractor shall provide barricades as required by the Contract Documents, governing agencies, and/or field conditions in order to protect public access pathways to existing buildings scheduled to remain open during any part of the Work.
   c. Contractor shall protect vehicular traffic, stored materials, Site, and existing structures from damage.
   d. Contractor shall provide and maintain temporary enclosures to prevent public entry to any construction area, and to protect all persons using other existing buildings and portions of the Site and/or premises Contractor shall maintain safe access to all existing facilities to remain in operation during any part of the Work.

8. **Temporary Water Control**
   a. Contractor shall comply with Section 01572 (Storm Water Pollution Prevention Plan.)

9. **Temporary Pollution Control**
   a. Contractor shall prevent the pollution of drains and watercourses by sanitary waste, sediment, debris and other substances resulting from construction activities. See Section 01572 and the other Contract Documents for additional information and requirements.
   b. No sanitary wastes shall be permitted to enter any drain or watercourses other than sanitary sewers. No sediment, debris or other substance shall be permitted to enter sanitary sewers without authorization of the receiving sanitary sewer service and all possible Best Management Practices (BMPs) shall be taken to prevent such materials from entering any drain to watercourse. Rate of discharge for storm water may be not increased by the Project during or following construction.
   c. In the event that dewatering of excavations is required, Contractor shall obtain the necessary approval and permits for discharge of the dewatering effluent from the local jurisdiction. Contractor shall be responsible for assuring that water quality of such discharge meets the appropriate permit requirements prior to any discharge.
   d. Contractor shall comply with the District Storm Water Pollution Prevention Plan for this Project.

10. **Construction Aids**
    a. Contractor shall furnish, install, maintain and operate all construction aids as required for the performance of the Work. Such construction aids include, but are not limited to, elevators and hoists, cranes, temporary enclosures, swing staging, scaffolding, and temporary stairs.

11. **Erosion Control**
a. Contractor shall comply with the Storm Water Pollution Prevention Plan for all Work on this Project including Work under this Specification Section. See Section 01572 and the other Contract Documents for additional information.

b. Contractor shall prevent soil erosion on the Site and adjacent property resulting from its construction activities to the maximum extent practical, including implementation of Best Management practices. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation or other operations that will disturb the natural protection.

c. Work shall be scheduled to expose areas subject to erosion for the shortest possible time and natural vegetation shall be preserved to the greatest extent practicable. Temporary storage, temporary construction buildings and temporary Field office buildings shall be located and construction traffic routed to minimize erosion. Contractor shall provide temporary fast-growing vegetation or other suitable ground cover shall be provided as necessary to control runoff.

12. Vehicular and Pedestrian Traffic Controls

a. Contractors shall coordinate with District’s Representative concerning vehicular traffic associated with the construction in order to minimize disruption to businesses and local residents. Delivery trucks and large equipment shall enter the Contractors access gate and shall use the route mutually agreed upon between District and Contractor at the beginning of each Phase of work. Contractor shall provide signage directing construction and delivery traffic to this gate. Contractor shall provide information regarding sign types, size, material, text and locations to be reviewed and approved by the District Representative prior to installation.

b. Contractor shall keep all required Fire District and emergency vehicle access paths free from obstruction at all times between the Notice to Proceed and the Substantial Completion dates.

13. Trees and Plant Protection

a. Contractor shall preserve and protect existing trees and plants on the Site that are not designated or required to be removed and those adjacent to the Site. See Specification Section 01416, Tree Protection Plan and other Contract Documents for additional information and requirements.

b. Contractor shall provide barriers to a minimum height of 4’- 0” around drip line of each tree and plant and around each group of trees and plants, as applicable, in the proximity of demolition and construction operations.

c. Contractor shall not park cars, trucks, store materials, perform Work or cross over landscaped areas. Contractor shall not dispose of paint, paint thinners, water from cleaning, plastering or concrete operations, or other deleterious materials in any landscaped areas, storm drain systems or sewers. Plant materials damaged as a result of the performance of the Work shall, at the option of the District and at the Contractor’s expense, either by replaced with new plant materials equal in size to those
damaged or by payment of an amount representing the value of the damaged materials as determined by the District.

d. Contractor shall remove soil that has been contaminated during the performance of the Work by oil, solvents and other materials which could be harmful to trees and plants and replace with good soil at Contractor’s expense.

e. Excavation within drip lines of trees shall be done only where absolutely necessary and with written permission from the District.

f. Where trenching for utilities is required within drip lines, tunneling under and around roots shall be by hand digging and shall be approved by the District. Main lateral roots and taproots shall not be cut. All roots 2 inches in diameter and larger shall be tunnelled under and heavily wrapped with wet burlap so as to prevent scarring or excessive drying. Smaller roots that interfere with installation of new work may be cut with prior approval by the District. Roots must first be cut with a Vermeer, or equivalent root cutter, prior to any trenching.

g. Where excavation for new construction is required within drip line of trees, hand excavation shall be employed to minimize damage to root system. Roots shall be relocated in backfill areas wherever possible. If encountered, immediately adjacent to location of new construction roots shall be cut approximately 6 inches back from new construction.

h. Approved excavations shall be carefully backfilled with the excavated materials approved for backfilling. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities. Do not use mechanical equipment to compact backfill. Tamp carefully using hand tools, refilling and tamping until Final Acceptance as necessary to offset settlement.

i. Exposed roots shall not be allowed to dry out before permanent backfill is placed. Temporary earth cover shall be provided or roots shall be wrapped with four layers of wet, untreated burlap and temporarily supported and protected from damage until permanently relocated and covered with backfill.

j. Accidentally broken roots should be sawed cleanly 3 inches behind ragged end.

k. See also Section 01416 Special Procedures, Tree Protection Plan.

14. Dust Control

a. Contractor shall conduct all demolition and construction operations to minimize the generation of dust and dirt and prevent dust and dirt from interfering with the progress of the Work and from accumulating in the Work and adjacent areas including, without limitation, occupied facilities and neighboring communities. See Specification Section 01416, Dust Control Plan and other Contract Documents for additional information and requirements.

b. Contractor shall periodically water exterior demolition and construction areas to minimize the generation of dust and dirt.

c. Contractor shall ensure that all hauling equipment and trucks carrying loads of soil and debris shall have their loads sprayed with water or covered with tarpaulins and as otherwise required by local and state ordinance.
d. Contractor shall prevent dust and dirt from accumulating on walks, roadways, parking areas and plantings from washing into sewer and storm drain lines.

e. Contractor shall provide power cleaning equipment including, but not limited to, street sweeper for cleaning up dust, debris and dirt from accumulating on public walks, roadways, parking areas and streets.

f. See also Section 01416 Special Procedures, Dust Control Plan.

15. **Temporary Signage**

a. See Section 01140, Work Restrictions, Drawing and other Contract Documents for additional information and requirements for temporary signage.

b. Project Identification and Temporary Signs: Contractor shall provide Project identification and other signs. Engage an experienced sign company to produce project signs. Install signs where indicated in Contract Documents. Unauthorized signs are not permitted.

c. Contractor shall provide minimum dimension 8’ – 0” wide by 4’- 0” high sign containing, Contra Costa Community College District, Project Name, Architect’s firm name, Construction Manager’s firm name, LEED logo and other related information as directed by District. Install in two (2) visible locations as approved by District.

d. Sign must be reviewed and approved by the District prior to installation.

e. Contractor shall provide temporary directional signs for construction personnel and visitors.

f. Contractor shall maintain and touch-up signs so they are legible at all times.

16. **Temporary Heat and Ventilation**

a. Provide temporary heat as required to maintain adequate environmental conditions to facilitate progress of the work, to meet specified minimum environmental conditions for the Work and to protect materials and finishes from damage due to improper temperature and humidity conditions.

b. Portable heaters shall be standard units complete with controls, appropriate safety features, and bear testing lab approval markings.

c. Provide adequate forced ventilation of enclosed areas as required for proper installation and curing of materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors and gases.

d. HVAC Equipment: Unless District authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

i) Use of gasoline-burning space heater, open-flame heater or salamander-type heating units is prohibited.

ii) Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

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**PART 2 – PRODUCTS**

Contra Costa Community College District  
Diablo Valley College  
D-4002 SRC Increment 2 – Expansion & Renovation
2.1 TEMPORARY FACILITIES/TEMPORARY FIELD OFFICE

A. Contractor shall provide Temporary Field Offices: Prefabricated or mobile units with serviceable finishes, heating and air conditioning systems, temperature controls, and foundations adequate for normal loading.

B. District Field Office Building: To accommodate 4 offices, 12 seat conference room, small storage room and 2 bathrooms gender neutral. Doublewide trailer to accommodate needs of District 4 Representatives. Furnishings shall be like new condition, no older than three years, except as noted below and subject to acceptance by District. Furnish and equip trailer and 4 offices as follows:

1. Five 4-drawer vertical file cabinets
2. Two plan tables capable of holding full size plans fully open
3. Plan racks sufficient to hold all project and shop drawings.
4. Four 5’ long desks with drawers
5. Four side tables for desks
6. Four new ergonomically adjustable, swivel office chairs on casters
7. Four 3’-wide 4-shelf book shelving units
8. Four 4’ x 5’ cork tack boards (for office)
9. Four 4’ x 5’ white board (1 for office, 1 for conference area)
10. One telephone line at desks and one at conference table
11. One new color copier/printer/scanner/machine, capable of producing at least 24 prints per minute, that will accommodate 8.5’ x 11”, 8.5” x 14”, and 11” x 17” paper. Contractor to provide maintenance for copy machine. Contractor shall supply ink and paper as needed or requested by District. This machine will be for use by District Representative for this project only.
12. Furnish and install one new flat screen 60-inch monitor in the Conference Room with HDMI cables to connect to District computers.
13. Two large full-size iPads.
14. One License for Bluebeam software.
15. Two Licenses for Primavera P6 software.
16. Two Bluetooth conference speakers.
17. Small Refrigerator.
18. Microwave.
19. 8 wastebaskets.
20. One trash can with lid outside the trailer. Trash to be emptied by Contractor as needed.
21. Operable mini blinds on all windows.
22. Intrusion alarm with motion sensor. Local bell only; no monitoring.
23. Fire extinguisher(s) as required by codes.
24. Smoke detectors (9-volt battery type) as required by codes.
25. All 4 offices with keyed entry door and two sets of keys.
26. Conference room of sufficient size to accommodate meetings of 12 individuals. Furnish room with conference table, folding chairs, 4’ x 5’ tack board and 4’ x 8’ white marker board.
27. Drinking water dispenser unit (supplying both hot and cold water) and bottled water service and continuous supply of paper cups until the District’s field office is removed from the Site.
28. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F, year-round.
29. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
30. Provide electrical power service and 120V AC duplex receptacles, with not less than one receptacle on each wall.
31. Keyed entry door locks and five sets of keys.
32. Submit proposed interior plan of field office to District for approval.
33. Using a licensed cleaning service subcontractor, clean the District’s field office building at least once a week, which includes vacuuming/washing floors, dusting and emptying trash from trailer to outside trash receptacle.
34. Utility Services: Contractor shall make all provisions and pay all installation and all other costs to provide telephone service, internet connection and services, electrical service, exterior lights and any local code and OSHA requirements. The Contractor shall pay all monthly charges for all services provided, including all local calls and any toll calls by the Construction Manager’s personnel to the Contractor’s home office, Architect’s home office, subcontractors, suppliers, and/or any other tolls calls specifically related to the Work.
35. Internet Services: Contractor shall provide internet connection using cable or DSL modem or equivalent to achieve a minimum speed of 6 Mbps for download and upload of data. Modem shall be Voice Over IP capable and be accompanied with wireless G capable router for District Construction Manager’s use only. Possible high speed providers are Comcast Cable (866-890-2061) or AT&T DSL (866-429-7222). In the event high speed internet technology is not available from Internet Service Providers, Contractor shall provide USB mobile broadband (Cellular 4G) cards for District computers from the Notice to Proceed through Final Completion.
36. All equipment provided under this section, with the exception of basic office furniture, shall become the property of the District upon final completion.

C. **Separate Project Inspector’s Field Office Building:** Provide heated and air-conditioned space for sufficient size to accommodate needs of Project Inspector, nominally 10’ x 20’. Project Inspector’s field office space may not be combined with Contractor’s or District’s field office building. Furnishings shall be like new condition, no older than three years, except as noted below and subject to acceptance by Project Inspector. Furnish and equip as follows:

1. Three 4-drawer vertical file cabinets
2. One plan table capable of holding full size plans fully open
3. Plan racks sufficient to hold all project and shop drawings.
4. Two 5’ long desks with drawers
5. Two side table for desk
6. Two swivel ergonomically adjustable office chair on casters
7. Two 3’-wide 4-shelf book shelving units
8. One 4’ x 5’ cork tack boards (for office)
9. One 4’ x 5’ white board (for office)
10. Two telephone lines (at desks)
11. One color copier/scanner/fax machine that will accommodate 8.5’ x 11”, 8.5” x 14”, and 11” x 17” paper. Contractor to provide maintenance for copy machine. Contractor will supply ink and paper as needed or required by inspector. This machine will be for use by Project Inspector representative for this project only.
12. Two wastebaskets
13. Operable mini blinds on all windows.
14. Intrusion alarm with motion sensor. Local bell only; no monitoring.
15. Fire extinguisher(s) as required by codes.
16. Smoke detector (9-volt battery type).
17. Drinking water dispenser. Provide bottled water refills throughout the project.
18. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F, year-round.
19. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
20. Provide electrical power service and 120V AC duplex receptacles, with not less than one receptacle on each wall.
22. Submit plans to District for approval.
23. Using a licensed cleaning service subcontractor, clean the Project Inspector’s field office building at least once a week, which includes vacuuming/washing floors, dusting and emptying trash from trailer to outside trash receptacle.
24. Utility Services: Contractor shall make all provisions and pay all installation and all other costs to provide telephone service, internet connection and services, electrical service, exterior lights and any local code and OSHA requirements. The Contractor shall pay all monthly charges for all services provided, including all local calls and any toll calls by the Construction Manager’s personnel to the Contractor’s home office, Architect’s home office, subcontractors, suppliers, and/or any other tolls calls specifically related to the Work.
25. Internet Services: Contractor shall provide internet connection using cable or DSL modem or equivalent to achieve a minimum speed of 6 Mbps for download and upload of data. Modem shall be Voice Over IP capable and be accompanied with wireless G capable router for District Construction Manager’s use only. Possible high speed providers are Comcast Cable (866-890-2061) or AT&T DSL (866-429-7222). In the event high speed internet technology is not available from Internet Service Providers, Contractor shall provide USB mobile broadband (Cellular 4G) cards for District computers from the Notice to Proceed through Final Completion.
26. All equipment provided under this section, with the exception of basic office furniture, shall become the property of the District upon final completion.

D. Access to Office Trailers: Provide paved pedestrian access path to all temporary offices.

E. Contractor’s Field Office: Provide as required for Contractor personnel.

F. Field office locations must be reviewed and approved by the District and Architect prior to installation.

G. Contractor’s Storage and Fabrication Sheds: Provide sheds sized, furnished and equipped to accommodate materials and equipment for construction operations.

H. Contractor shall be responsible for Temporary field offices/facilities, security and protection.

2.2 EQUIPMENT

A. Fire Extinguishers: Contractor shall provide Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures according to NFPA 10.

B. First Aid Supplies: In compliance with governing regulations.

2.3 MATERIALS

Not used

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of Work. Relocate and modify facilities as required by progress of the Work during entire project including all phases of project.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Contractor shall verify and coordinate all relocation of facilities with the District Representative.

3.2 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion and acceptance by the District.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use a permanent facility or no later than Final Completion. Complete or, if necessary, restore permanent construction that may have been
delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. District reserves the right to take possession of Project Identification signs at no cost to the District.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. Clean and renovate permanent facilities used during construction period prior to Final Completion. Comply with final cleaning requirements specified in Section 01770, Contract Closeout Procedures.

END OF SECTION 01500
SECTION 01505
CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01010 – “Summary of Work”
B. Section 01400 – “Quality Control Plan”
C. Section 01412 - “Hazardous Material”
D. Divisions 2 through 33 Sections for Construction and Demolition Waste Management requirements for the work in those Sections.

1.3 SUMMARY

A. The District has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.
B. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.
C. The existing buildings that are shown to be demolished by the Contractor in the Contract Documents currently contain furniture, fixtures and equipment (FF&E)-both fixed and movable. The District has determined said FF&E has zero salvageable value. Therefore, for bidding purposes, the Contractor shall bid removing and disposing of said FF&E assuming and allocating zero-dollar value to whatever FF&E remains when the Contractor takes possession of the Site. Contractor shall include said FF&E in its Waste Management Plan that is submitted to the District. The Contractor is also advised that the District is in the process of removing some, but not all, of the movable FF&E through its normal Purchasing Department process by the anticipated Notice of Award date. (ADD. E)

1.4 WASTE MANAGEMENT GOALS FOR THE PROJECT

A. The District has established that this Project shall minimize the creation of construction and demolition waste and shall divert a minimum of 65% of Project generated waste from landfills, or as designated by Cal Green Code Requirements; whichever is greater. Factors that contribute to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, and contamination, shall be minimized. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized. Both recycled and waste need to be logged and documented by volume and weight.
B. Diversion Goals: A minimum 65% of total Project waste shall be diverted from landfill. The following waste categories, at a minimum, shall be diverted from landfill. The Contractor’s Waste Management Plan shall establish a program for reusing or recycling materials which are recyclable. These materials include, but not limited to:

1. Landscape and land clearing debris (green wood materials)
2. Asphalt pavement
3. Gravel and aggregate products
4. Concrete
5. Masonry scrap and rubble (brick, concrete, masonry, stone)
6. Metals (ferrous and nonferrous)
7. Clean wood (dimensional lumber, sheet goods, millwork, scrap, pallets)
8. Plastics (films, containers, PVC products, polyethylene products)
9. Asphalt/Bituminous roofing
10. Insulation Materials
11. Glass (un-tempered)
12. Door and window assemblies
13. Carpet and carpet pad
14. Fibrous acoustic materials
15. Ceiling Tiles
16. Plumbing fixtures and equipment
17. Mechanical equipment
18. Lighting fixtures and electrical components
19. Cardboard packing and packaging
20. Furniture
21. Sheet Rock
22. Electronic Waste
23. Universal Waste
24. Paper

1.5 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, grease solvents, caulk, no Freon with air-conditioning units or similar products.

B. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial, and industrial waste, including construction, remodeling, repair, and demolition operations.

C. Commingled or Off-site Separation: Collecting all material types into a single bin or mixed collection system and separating the waste materials into recyclable material types in an off-site facility.

D. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash debris and rubble resulting from construction, remodeling repair and demolition operations. Hazardous materials are not included.

E. Debris: Including both combustible and noncombustible wastes, such as leaves and tree trimmings that result from construction or maintenance and repair work.

F. Deconstruction: The process of removing existing building materials from renovation and demolition projects for the purposes of reuse, and recycling, in an efficient and safe manner possible.
G. Divert or Diversion from Landfill: To remove, or have removed, from the site for recycling, reuse or salvage material that might otherwise be sent to a landfill. Diversion from Landfill does not include using the material as alternative daily cover at a landfill site, nor does it include burning, incinerating, transformation processing or thermally destroying waste.

H. Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively.

I. Recovery: Any process that reclaims materials, substances, energy, or other products contained within or derived from waste on-site. It includes waste-to-energy, composting, and other processes.

J. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product.

K. Recycle (recycling): To sort, separate, process, treat or reconstitute solid waste and other discarded materials for the purpose of redirecting such materials into the manufacture of useful products. The process of collecting and preparing recyclable materials in their original form, or in manufacturing processes, that do not cause the destruction/contamination of recyclable materials in a manner that precludes further use. Recycling does not include burning, incinerating, transforming or thermally destroying waste.

L. Return: To give back reusable items or unused products to vendors.

M. Reuse: Using a material or product that is recovered from construction, renovation, or demolition activities.

N. Reuse on Site: To reuse excess of discarded construction material in some manner on the Project site.

O. Rubbish: Including both combustible and noncombustible wastes, such as paper, boxes, glass, crockery, metal and lumber scrap, tin cans, and bones.

P. Salvage: to remove a waste material from the Project site for resale or reuse.

Q. Sources Separation: Sorting the recovered materials into specific material types with no or a minimum amount of contamination on site.

R. Time-Based Separation: Collecting waste during each phase of construction or deconstruction which results in primarily one major type of recovered material. The material is removed before it becomes mixed with the material from the next phase of construction.

S. Waste Materials: Large and small pieces of listed materials which are excess to contract requirements and generally include materials to be recycled and/or recovered from existing construction and items of trimmings, cuttings, and damaged goods resulting from new installations, which can be effectively used in the Work. Extra material or material that has reached the end of its useful life in its intended use.

1.6 REFERENCES AND RESOURCES

A. This information is provided for Contractor’s convenience only, and the District does not warrant its accuracy. County specific information is available on the Contra Costa County Waste Reduction and Recycling web page at http://www.co.contra-cost.ca.us/depart/cd/recycle/index.html. Additional information may also be found at the county conservation web page at http://www.cccounty.us/index.aspx?NID=285. Refer to the Contra Costa County Builder’s Guide to Reuse & Recycling and the Contra Costa County Recycling
Guide. Both are available from Contra Costa County. Contact Lorna Thomson at 925-674-8823 (lorna.thomson@dcd.cccounty.us) for assistance in the management of construction & demolition debris.

B. The recyclers listed below provided for the convenience of Contractor. No preference is given to the recyclers listed below. Contractor shall contact any additional resources as required to complete the work. Some of the names and numbers may be out of date, and Contractor shall not rely on the information presented in this Section in preparing its Bid or its Waste Management Plan.

1. Cardboard: Contact: National Recycling Corporation (510) 268-1022; California Waste Solutions (510) 836-6200; Community Conservation (510) 524-0113. May find the public will remove if made available.


3. Usable Palettes Contact: Return to product vendors or recycle: Industrial Pallet (510) 489-4050.


5. Metals from banding, ductwork, piping, rebar, roofing, steel studs, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze: Contact: Alliance Metals (510) 547-2408; Aaron Metals (510) 569-6767; DC Metals (510) 836-2655; Lakeside Non-Ferrous Metals, (510) 444-5466; Waste Management, Inc., (916) 374-2711.

6. Carpet and pad: Contact: Return to manufacturer; donate large remnants to Habitat for Humanity (510) 251-6304 or other non-profit.

   a. Contact, hazardous waste management: Alameda County Household Waste Management Program (800) 606-6606; Safety Clean (510) 832-7942.

8. Insulation: Check with manufacturer or installer for take-back programs.


10. Gypsum Board: Contact: Zanker Resource Management (408) 263-2383.

C. The following sources provided for references:

1. BuildingGreen.com

2. California Integrated Waste Management Board

3. EPA Office of Solid Waste and Energy Response


1.7 WASTE MANAGEMENT PLAN

A. Waste Management Plan: Within 10 calendar days after receipt of Notice of Award, or prior to any waste removal, whichever occurs sooner, Contractor shall submit to the District and District’s Representative a Waste Management Plan, tailored to this project and Site, for review and acceptance. The Waste Management Plan shall include, but not limited to, the following:
1. The Contractor shall designate an on-site party (or parties) as the Waste Management Plan Program Manager responsible for instructing workers and overseeing and documenting results of implementation of the Waste Management Plan for the Project.

2. Indicate how the Contractor proposes to recover at least 75% of the wastes for reuse and recycling.

3. The Waste Management Plan should coordinate the recovery effort with the construction, and renovation / demolition schedule.

4. Indicate compliance with this specification’s section on Quality Assurance.

5. Description of the regular meetings to address waste management.

6. Include a list of reuse facilities, recycling facilities and processing facilities that will be receiving the recovered materials (including take back by District or on-site auctions.)

7. If some of the materials will be donated or sold on-site auctions, describe the process and identify the organizations that may receive the materials.

8. Identify materials that are not recyclable or not recovered which will be disposed of in a landfill (or other means acceptable by the State of California and local ordinance and regulations) and explain why the materials are not recovered.

9. List the permitted landfill, or other permitted disposal facilities, that will be accepting the disposed waste materials.

10. Indicate instances or situations where compliance with the requirements of this specification do not apply or do not appear to be possible.

11. Identify each type of waste material to be reused or recycled and estimate the amount, by weight.

12. Provide estimate of time requirements for demolition and for the removal of valuable reusable items and materials.

B. Revise and resubmit the Waste Management Plan as required by District.

C. Acceptance of Contractor’s Waste Management Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements. Comply with applicable requirements of the State of California, local ordinances and regulations concerning management of construction, clearing, and inert materials.

B. Disposal Site, Recyclers and Waste Materials Processors. Use only facilities properly permitted by the State of California, and/or by local authorities where applicable.

C. Pre-Work Waste Management Plan Meeting.

1. Prior to beginning work at the Site, schedule and conduct a meeting to review the Waste Management Plan and discuss procedures, schedules, coordination and specific requirements for waste materials recycling and disposal. Discuss coordination and interface between Contractor, sub-contractors, architect, engineers, project manager, District, and other waste management activities. Identify and resolve problems of compliance with requirements. Record minutes of the meeting, identifying conclusions.
reached and matters requiring further resolution. Maintain waste management as an agenda item at future construction meetings.

2. Attendees: Contractor and related contractor personnel associated with work of this section, including personnel in charge of the waste management program; Waste Management Plan Program Manager; architect; engineers; material and equipment suppliers where appropriate; and such additional District personnel as District deems appropriate.

3. Waste Management Plan Revision: Make revisions to Waste Management Plan agreed upon during the meeting and incorporate resolutions agreed to be made subsequent to the meeting. Submit revised Waste Management Plan to the District as District deems appropriate for acceptance.

1.9 RECYCLING PROGRAM

A. The recycling program could utilize one or a combination of any of the following common waste diversion strategies:
   1. Sources Separation
   2. Time-Based Separation
   3. Commingled or Off-site Separation
   4. Back haul of packaging
   5. On-site sales auctions and removal.

B. Waste Material management hierarchy can be viewed as: reuse on-site, recycle on-site, reuse off-site, and recycle off-site.

1.10 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Plan Distribution:
   1. Contractor shall provide copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, job site Superintendent, Project Inspector, District, and Architect or Engineer.
   2. Contractor shall provide Waste Management Plan to comply with this Section 01505.

B. Instruction: Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages and/or phases of the Project.

C. Meetings: Contractor shall conduct Construction Waste Management Plan meetings. Meetings shall include all subcontractors affected by the Waste Management Plan. At a minimum, waste management goals and issues shall be discussed at the following meetings:
   1. Pre-bid meetings.
   2. Pre-construction meeting; (including pre-construction meeting for the Project)
   3. Regularly scheduled job-site meetings.

D. Separation Facilities: Contractor shall designate a specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid co-mingling of materials. Bins
shall be protected during non-working hours from offsite contamination. Secure waste collection areas to protect from wind, access, rain, run off, ground contamination, etc.

E. Materials Handling Procedures: Materials to be recycled shall be protected from contamination, and shall be handled, stored and transported in a manner that meets the requirements set by the designated facilities for acceptance.

1.11 PROGRESS DOCUMENTATION

A. Provide the Contractor’s Waste Program Manager with delivery receipts for the recovered materials and waste materials sent to the permitted recycling facilities, processing facilities, or landfill with the following information on a form to be approved by the District:
1. Name of firm accepting the recovered materials or waste materials
2. Specify type of facility (e.g. retail facility, recycler, processor, Class III landfill, MRF)
3. Location of the facility
4. Type of materials
5. Net weights (or volume) of each type of material
6. Date of delivery
7. Value of the materials or tipping fee paid

B. Document on form shall be reviewed and approved by District.

C. Application for Progress Payments: Contractor shall submit with each Application for Progress Payment a Summary of the project waste generated. Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment. The District and its representatives shall not be responsible for delay Progress Payment. With each Application for Payment, submit required Progress Documentation, including:
1. Manifest;
2. Weight tickets;
3. Receipts; and
4. Invoices specifically identifying the project and waste material.

D. Record Submittals: With Record Submittals as specified in Section 01330, submit the following:
1. Summary of solid waste disposal and diversion. Submit on form preapproved by District.
2. Estimate of total Project waste to be generated; name of the landfill(s) where Project waste would normally be disposed of.
3. Estimate of amounts (weight, feet, square yards, gallons, etc.) All waste categories listed.
4. Estimate of net cost revenue or additional costs resulting from separating and recycling, (versus land filling), each material. Net means that the following have been subtracted from the cost of separating and recycling:

PART 2 - PRODUCTS

Not Used
PART 3 - EXECUTION

3.1 STORAGE AND HANDLING

A. Site Storage
   1. Remove materials for recycling and recovery from the work locations to approved containers or storage area as required. Failure to remove waste or recovered materials will be considered cause for withholding payment and termination of Contract.
   2. Position containers for recyclable and recoverable waste materials at a designated location on the Site. If materials are sorted on Site, also provide a sorting area and necessary storage containers.
   3. Change-out loaded containers for empty containers, as demand requires.
   4. If recovered materials are stored on-site for project duration, provide adequate security from pilferage.

B. Handling
   1. Deposit indicated recyclable, and recoverable materials in storage areas or containers in a clean (no mud, adhesive, solvents, petroleum contamination), debris-free condition. Do not deposit contaminated materials into the containers until such time as such materials have been cleaned.
   2. Insure all recovered materials are made safe for handling and storage.
   3. If the contamination chemically combines with the material so that it cannot be cleaned, do not deposit into the recycle containers. In such case, request resolution by the District for disposal of the contaminated material. Directions from the District do not relieve the Contractor of responsibility for compliance with all legal and regulatory requirements for disposal, nor shall such directions cause a request for modification of the Contract.

3.2 PROJECT CONDITIONS

A. Site Condition:
   1. Signs and instructions should be clear, and easy to understand. All recycling containers should be clearly labeled and lists of acceptable and unacceptable materials will be posted throughout the site. Whenever possible, they should be in multiple-languages, especially in Spanish, and in graphic symbols.
   2. The Contractor shall ensure the safety of all personnel involved in the waste management process.
   3. As a part of the Waste Management Plan, a site management plan shall be created including: work areas, materials processing areas, materials storage and disposal areas, worker hand-washing and changing stations, first aid and medical information.

END OF SECTION 01505
SECTION 01540
SITE SECURITY AND SAFETY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01311 – “Project Management and Coordination”
C. Section 01312 – “Project Meetings”
D. Section 01410 – “Regulatory Requirements”
E. Section 01412 – “Hazardous Materials”
F. Section 01416 – “Special Procedures”
G. Section 01500 – “Temporary Facilities and Control”
H. Section 01770 – “Contract Closeout Procedures”
I. Section 01780 – “Project Record Documents”
J. Divisions 2 through 33 Sections for Site Security and Safety requirements for the work in those Sections.

1.3 SUMMARY
A. This Section specifies the requirements for Site safety and security.

1.4 CONTRACTOR RESPONSIBILITIES
A. The Contractor is constructive owner of Project site.
B. The Contractor shall be responsible for all damages to persons or property that occur as a result of its fault or negligence in connection with the prosecution of this Contract and shall take all necessary measures and be responsible for the proper care and protection of all materials delivered and work performed until Final Completion by the District.
C. All work shall be solely at the Contractor’s risk, with the exception of damage to the work caused by “acts of God” as defined in Public Contract Code Section 7105(b)(2).
D. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety programs required by applicable law, ordinance, regulation or governmental orders in connection with the performance of the Contract, or otherwise required by the type or nature of the Work.
E. Without limiting or relieving the Contractor of its obligations hereunder, the Contractor shall require that its Subcontractors similarly initiate and maintain all...
appropriate or required safety programs. Prior to commencement of Work at the Site, the Contractor shall provide the District with the Contractor’s proposed site-specific safety plan for the Work for the District’s review.

F. Contractor shall take, and require all subcontractors to take, all necessary precautions for safety of workers on the Work and shall comply with all applicable federal, state, local and other safety laws, standards, orders, rules, regulations, and building codes to prevent accidents or injury to persons on, about, or adjacent to premises where Work is being performed and to provide a safe and healthful place of employment.

G. In addition to meeting all requirements of OSHA, Cal-OSHA, state, and local codes, Contractor shall furnish, erect and properly maintain at all times, as directed by District or required by conditions and progress of work, all necessary safety devices, safeguards, construction canopies, signs, audible devices for protection of the blind, safety rails, belts and nets, barriers, lights, and watchmen for protection of workers and the public, and shall post danger signs warning against hazards created by such features in the course of construction.

H. The Contractor and Subcontractors shall continuously protect the Work, the District’s property, and the property of others, from damage, injury, or loss arising in connection with operations under the Contract Documents. The Contractor and Subcontractors, at their own expense, shall make good any such damage, injury, or loss, except such as may be solely due to, or caused by, agents or employees of the District. The Contractor shall immediately repair or replace all property damaged or lost due to Contractor’s, or Subcontractor’s, failure to protect the Work or otherwise caused by Contractor or Subcontractor operations. A determination as to cause of damage or insurance or risk coverage at any level shall not delay repair or replacement. Contractor shall not rely on District insurance or risk coverage. If Contractor or Subcontractor disagrees with the District’s determination of cause, a claim may be filed in accordance with these Contract Documents.

I. Contractor shall maintain protection as necessary to protect the Work, as a whole and in part, and adjacent property and improvements from accidents, injuries or damage.

J. Contractor shall protect the Work, material, and/or equipment to be incorporated therein, whether in storage on or off the Site, and under the care, custody, or control of the Contractor or the Contractor’s Subcontractors.

K. Contractor shall correct any violations of safety laws, rules, orders, standards, or regulations. Upon the issuance of a citation or notice of violation by the Division of Occupational Safety and Health, such violation shall be corrected promptly.

L. Contractor shall require that Subcontractors participate in, and enforce, the safety and loss prevention programs established by the Contractor for the Project, which will cover all Work performed by the Contractor and its Subcontractors.

1. Subcontractors shall enforce the District’s and the Contractor’s instructions, laws, and regulations regarding signs, advertisements, fires, smoking, the presence of liquor, and the presence of firearms by any person at the Site.
2. Each Subcontractor shall designate a responsible member of its organization whose duties shall include loss and accident prevention, and who shall have the responsibility and full authority to enforce the program. This person shall attend meetings with the representatives of the various Subcontractors employed to ensure that all employees understand and comply with the programs.

3. All Subcontractors and material or equipment suppliers shall cooperate fully with Contractor, the District, and all insurance carriers and loss prevention engineers.

4. Subcontractors shall immediately report in writing to the Contractor all accidents whatsoever arising out of, or in connection with, the performance of the Work, whether on or off the Site, which caused death, personal injury, or property damage, giving full details and statements of witnesses.

1.5 CONFORMANCE WITHIN ESTABLISHED LIMITS

A. The Contractor and Subcontractors shall confine their construction equipment, the storage of materials, and the operations of workers to the limits indicated by laws, ordinances, permits, and the limits established by the District, or the Contractor in the case of Subcontractors, and shall not unreasonably encumber the premises with construction equipment or materials.

1.6 CONTRACTOR NOTICES

A. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on the safety of persons or property or their protection from damage, injury, or loss.

1.7 SITE SAFETY OFFICER

A. Contractor shall designate a responsible member of its organization on the Work, whose duty shall be to enforce the Contractor’s Safety program Plan, post information regarding protection and obligations of workers and other notices required under occupational safety and health laws, to comply with reporting and other occupational safety requirements, and to protect the life, safety and health of workers. The name and position of person so designated shall be reported to District in writing by Contractor within ten (10) days of award of the Contract.

B. District’s representative(s) shall be allowed access to accident/injury and illness reports, inspection reports, scheduling and construction meetings, and safety meetings.

1.8 SAFETY PROGRAM PLAN

A. Prior to commencing Work at the Site, Contractor shall submit a Safety Program Plan specifically tailored for this Project and this Site that has been reviewed and approved by an Industrial Hygienist certified by the American Board of Industrial Hygiene or a Certified Safety Professional. The Safety Program Plan shall include the name, certification number, and certification seal of the Industrial Hygienist or Certified Safety Professional. Comply with the Safety Program and all applicable federal, state, and local regulation codes, rules, law and ordinances during the course of the Work.

B. The Contractor’s Safety Program Plan shall include all actions and programs necessary for compliance with California or federally statutorily mandated...
workplace safety programs, including without limitation, compliance with the California Drug Free Workplace Act of 1990 (California Government Code SS 8350 et seq.)

C. Plan shall comply with the requirements of the Occupational Safety and Health Act, and other applicable federal, state and local standards.

D. Contractor shall keep copies of all health and safety-related plans on the Site at all times.

E. Receipt and/or review of the Safety Program Plan by District shall not relieve Contractor of any responsibility for complying with all applicable safety regulations.

F. It is essential that Contractor and each Subcontractor implement an effective and vigorous site-specific Safety Program for the Work.

G. The Contractor shall have sole responsibility for Project safety, and shall be solely responsible for providing a safe workplace

H. Safety Program Plan Components:
   1. Injury and Illness Prevention Program (IIPP): Conforming to the General Industrial Safety Orders (CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 3203), and the California Labor Code (Section 6401.7).
   2. Site-Specific Safety and Health Plan (SSHP): This Plan shall describe the health and safety procedures that shall be implemented during the Work in order to ensure safety of the public and those performing the Work. Follow the guidelines for a SSHP listed in CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 5192, Item (b)(4) f.
   3. Permit-Required Confined Space Program: (CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 5157). Permit-required space entry is allowed only through compliance with a permit-required confined space program meeting the requirements of Section 5157 of the General Industrial Safety Orders. During entry operations, or at the conclusion of entry operations, verbally notify Engineer of the permit space program followed, and of any hazards confronted or created in permit-required spaces during entry operations.
   4. A written and certified workplace hazard assessment as required by OSHA and Cal OSHA, updated on a regular basis, and maintained on site. The certified hazard assessment shall be made available immediately upon request by the District, the Architect, or the Inspector of Record.

I. Supply sufficient hard hats to properly equip all employees, workers, and visitors. Hard hats shall be mandatory as per CAL OSHA Construction Safety orders.

J. Whenever an exposure exists, appropriate personal protective equipment (PPE) shall be used by all affected personnel. Contractor shall provide PPE to all personnel under Contractor’s direction and responsibilities.

K. After review by District, the implementation and enforcement of all Safety-related plans shall become the responsibility of the Contractor and Site Safety Officer. The Contractor shall notify the District in writing of any changes to Safety-related plans.
1.9 SAFETY PRECAUTIONS

A. The Contractor shall be solely responsible for initiating and maintaining reasonable precautions for safety of, and shall provide reasonable protection to prevent damage injury or loss to:

1. Employees on the Work and other persons who may be affected thereby
2. The Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor’s Subcontractors or Sub-subcontractors
3. Other property or items at the site of the Work, or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction. The Contractor shall
4. take adequate precautions and measures to protect existing roads, sidewalks, curbs, pavement, utilities, adjoining property and improvements thereon (including without limitation, protection from settlement or loss of lateral support), and to avoid damage thereto. Without adjustment of the Contract Price or the Contract Time, the Contractor shall repair, replace or restore any damage or destruction of the foregoing items as a result of performance or installation of the Work.
5. The Contractor shall at all times maintain good housekeeping practices to reduce the risk of fire damage.
6. Good housekeeping practices shall be maintained continually on all areas of the Site and the Work. District may request that the Contractor hire additional staff or help until housekeeping in a work or storage area is improved. All scrap materials, rubbish and trash shall be removed daily from in and about the building and shall not be permitted to be scattered on adjacent property.

B. Suitable storage space shall be provided outside immediate building areas for storing flammable materials and paints. Excess flammable liquids being used inside the building shall be kept in closed metal containers and be removed from the building during unused periods.

C. A fire extinguisher shall be available at each location where cutting or welding is being performed. Where electric or gas welding or cutting work is done, interposed shields of incombustible material shall be used to protect against fire damage due to sparks and hot metal. When temporary heating devices are used, a watchman shall be present to cover periods when other workmen are not on the premises.

D. The Contractor shall provide fire extinguishers in accordance with all OSHA and Cal OSHA requirements, and the recommendations NFPA Bulletins Nos. 10 and 241.

1.10 REQUIREMENTS FOR EXISTING SITES

A. Deliver materials to building area over route(s) approved by the District.

B. Take preventive measures to eliminate objectionable dust, noise, or other disturbances.

C. Confine apparatus, the storage of materials, and the operations of workers to limits indicated by law, ordinances, permits or directions of Architect; and not interfere with the Work or unreasonably encumber premises or overload any structure with materials;
and enforce all instructions of District and Architect regarding signs, advertising, fires, and smoking and require that all workers comply with all regulations while on the Site.

D. Take care to prevent disturbing or covering any survey markers, monuments, or other devices marking property boundaries or corners. If such markers are disturbed by accident, they shall be replaced by a licensed land surveyor or civil engineer, and all lawfully required maps and records shall be filed with county and local authorities at no cost to the District. All related filing and plan check fees shall be paid by Contractor.

E. Contractor shall take adequate precautions to protect existing roads, sidewalks, curbs, pavements, utilities, adjoining property and structures (including, without limitation, protection from settlement or loss of lateral support), and to avoid damage thereto, and repair any damage thereto caused by construction operations. All permits, licenses, or inspection fees required for such repair Work shall be obtained and paid for by Contractor.

F. The Contractor, at Contractor’s expense, will remove all mud, water, or other elements as may be required for the proper protection of existing improvements, and prosecution of the Work.

G. Protect all other property at the Site or adjacent thereto as required, such as trees, shrubs, lawns, walks, pavement, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

1.11 SAFETY AND EMERGENCY CONDITIONS

A. Emergency Action: In an emergency affecting the safety of persons or property, the Contractor shall take any action necessary, at the Contractor’s discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided herein. Emergency conditions shall be any condition at the Site which has the actual or potential for significant adverse effects to persons or property, whether or not resulting from the Contractor’s operations.

B. Accident Reports: The Contractor shall promptly report in writing to the District all accidents arising out of or in connection with the Work, which caused death, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the District and Campus Police Department.

C. The District’s Representatives and Project Inspector, as appropriate, shall be notified of the existence of such a condition, but shall not be called upon to perform any emergency service. The fact that the District may not respond to the emergency condition shall not be used as an excuse by the Contractor to neglect immediate action; nor will the District or its Representatives be liable for any resulting condition. The fact that a representative of the Contractor may not be present when emergency conditions occur shall not relieve the Contractor from an immediate response to the situation which shall return the disruption to normalcy.

D. If the emergency circumstances are not the result of any fault or neglect of the Contractor, the Contract time shall be adjusted to reflect the actual direct effect of such
actions to the then critical path of the Construction Progress Schedule. The foregoing notwithstanding, adjustments of the Contract Price or the Contract Time for actions taken by the Contractor in response to emergency circumstances shall be subject to the Contractor’s strict compliance with all other applicable provisions of the Contract Documents relating to notices and time for delivery of notices.

1.12 SAFETY SIGNS AND BARRICADES

A. The Contractor shall erect and maintain, as required by existing conditions and conditions resulting from performance of the Contract, reasonable safeguards for safety and protection of property and persons, including, without limitation, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying Districts and users of adjacent sites and utilities.

B. Contractor shall properly protect the Work:
   1. With lights, guard rails, fencing, temporary covers and barricades.
   2. Enclose excavations with proper barricades.
   3. Brace and secure all parts of the Work against to protect against inclement weather and to prevent accidents.

C. Provide such additional forms of protection that may be necessary under during the course of the Work.

D. Contractor shall provide and maintain in good condition all protective measures required to adequately protect the public from hazards resulting from the Work. When regulated by Building Code, Cal OSHA, or other authority, such legal requirements for protection shall be considered as minimum requirements. Contractor shall be responsible for the protection in excess of such minimum requirements as required.

E. Contractor shall prevent unauthorized persons from the entering the Work Site(s).

1.13 CONTROL OF SITE

A. Contractor shall ensure that no alcohol, firearms, weapons, or controlled substances are present on the Project Site. Contractor shall immediately remove from the Site and terminate from this Project the employment of any employee found in violation of this provision.

1.14 SITE SECURITY

A. Contractor shall take and be fully responsible for all reasonably required measures to protect and maintain the security of persons, existing facilities, and property at the Site, including prevention of theft, loss, and/or vandalism by persons lawfully present on the Site, including non-working times. Contractor’s measures shall include, at a minimum, maintaining a log of all persons entering and leaving the Site, who they represent, what they are delivering, and to whom.

B. No claim shall be made against District by reason of any act of an employee or trespasser, and Contractor shall repair all damage to District’s property resulting from Contractor’s failure to provide adequate security measures.
C. But for immediate access to and from the Contractor controlled Site and staging area(s), the access gates shall remain closed and locked at all times. Contractor shall appoint one person to monitor access through the gate and maintain the sign-in/out list. Alternatively, Contractor may provide a full-time security guard at the gate to control access and maintain the sign-in/out list. The sign in/out list shall be available to District at any time upon request. If District determines that the gate has been left unlocked, Contractor shall, if requested by District, provide a full-time guard at no additional expense to the District. (ADD. E)

D. The Contractor and the Subcontractors shall use only those ingress and egress routes designated by the District, observe the boundaries of the Site designated by the District, park only in those areas designated by the District, which areas may be on or off the Site, and comply with any parking control program established by the District, such as furnishing license plate information and placing identifying stickers on vehicles.

E. Contractor shall supply all security fencing, barricades, lighting, and other security measures as required to protect and control the Site.

F. The Contractor shall be responsible for providing security services for the Site as needed for the protection of the Site and as determined in the District’s sole discretion.

1.15 OPERATORS OF MOBILE EQUIPMENT SAFETY

A. Under Federal and State Safety requirements, Contractor must certify that all operators of mobile equipment including but not limited to forklifts, cranes, man-lifts, scissor and boom lifts, and similar equipment are required to have been trained and/or certified on the proper operation of such equipment. Copies of equipment training and certification records shall be forwarded, upon request, to the District.

1.16 SAFETY REQUIREMENTS

A. Contractor shall meet and comply with requirements of current local, State and Federal regulations.

B. Contractor shall meet and comply with the following rules:

1. The Contractor will provide and maintain at the Site first-aid supplies that comply with the current Occupational Safety and Health Regulations.

2. Hard hats shall be worn at all times. (This includes welders when using welding hoods)

3. Sleeved shirts shall be worn at all times. (No tank tops)

4. If required, Fire Retardant Clothing (FRC) shall be supplied by Contractor for all their employees.

5. One Hundred Percent (100%) Fall Protection Policy: All subcontract employees shall comply with Fall Protection Policy. The Policy simply states, “Anytime employees are working from an unprotected elevation of six (6) feet or more, fall protection must be used.” Working, as stated above, means while traveling, stationary, or anytime exposed to a fall from a surface not protected by approved handrails, cable or some other approved fall elimination device. Adherence to this policy is a requirement of your Subcontract.
C. Hazards Control:
   1. When use or storage of any hazardous materials or equipment, or unusual method is necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel. The Contractor shall notify the District any time that explosives or hazardous materials are expected to be stored on Site. Location of storage shall be coordinated with the District and local fire authorities.
   2. Store volatile wastes in covered metal containers and remove from premises daily.
   3. Prevent accumulation of wastes that create hazardous conditions.
   4. Provide adequate ventilation during use of volatile or noxious substances.

D. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
   1. Do not burn or bury rubbish or waste material on the Site.
   2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
   3. Do not dispose of wastes into streams or waterways.

E. Provide accident information on the forms provided by Contractor. This information shall be provided on the same day as the occurrence of said incident, and shall be submitted to District within a reasonable time.

1.17 ADDITIONAL SAFETY CONTROLS

A. According to industry practices, it is the responsibility of the Contractor and subcontractors of every tier to exercise reasonable care to prevent work-related injuries and property and equipment damage at the Site, as well as minimize risk to the public and third-party property. The Contractor, all sub-contractors, suppliers, and installers shall undertake loss control prevention practices according to the requirements set forth by federal, state and city laws, statutes, and the specific procedures developed for this Project.

B. Contractors and subcontractors participating in the project will be expected to comply with the following safety and loss control requirements:
   1. All sub-contractors, suppliers, and installers shall identify their contact person(s) to the Contractor.
   2. Follow District procedures regarding dealing with the media, including, but not limited to, TV, Radio, and Newspaper.
   3. All construction employees will be required to be attired in workpants, shirt and appropriate boots or closed toe shoes.
   4. Smoking is prohibited on the Site.
   5. Controlling access to the construction site is a very high priority, and Contractors will be required to take whatever preventative measure, such as barriers, fencing, etc., as outlined in the Contract Documents.
   6. Construction personnel cannot enter District property other than the construction site unless accompanied by District personnel, and they are allowed only
‘incidental’ contact with students. Violations of these requirements by any construction employee will result in a mandatory background check of that employee – including fingerprinting – as required by state law.

7. Fall protection is mandatory on all projects in accordance with CAL OSHA, OSHA and any other Local, State, and Federal appropriate code and requirements.

8. Personal radios, headsets, Walkman’s and CD players are not allowed on the Site.

9. All Contractors must attend the pre-construction safety meeting.

10. No sexual reference or preference shall be permitted on any piece of clothing or the hardhat. Any employee observed disregarding this policy shall be removed from the Site until further notice from the District.

11. Contractor personnel and subcontractor personnel at all levels will refrain from interacting with Campus staff or students unless required to prevent an unsafe situation. Personnel found speaking to staff or students for any reason unrelated to the Work or Safety shall be removed from the Site and not be allowed to return.

12. All Contractors’ employees shall park in their designated parking area. Any sticker attached to the employees’ vehicle that displays any form of sexual preference or reference shall be removed prior to parking at the Site. Each employee will provide their license plate number to the Contractor. Any employee disregarding this policy shall be removed from the Site until further notice from the District.

13. The Contractor shall control the break time activities of the employees to assure the cleanup of all soda cans, food wrappers, plastic bottles, or food containers from the break area. Such areas shall be cleaned immediately after the break and all waste placed in trash receptacles.

14. Theft or willful damage to any property of the District, student, or other Campus or District personnel will be prosecuted fully by the District.

15. No guns, switchblades, or knives with blades greater than two inches shall be allowed on the Site. Any employee disregarding this policy shall be removed from the Site until further notice from the District.

C. The Contractors and all subcontractors, suppliers and installers participating in the Project will further be expected to comply with the following safety and loss control requirements:

1. All Contractor, subcontractors, supplier, and installer personnel shall comply with all District, local, state, and federal emergency responder directions in the event of an emergency or disaster.

2. Any Contractors’ employee observed providing or selling cigarettes or other smoking materials to students shall be removed from the Site.

3. All Contractors will agree to conduct and fund post-injury drug screening of their employees. Those employees failing the test will be removed permanently from the Site.

4. The District has the right to instruct the Contractor to correct an unsafe act or condition. If the Contractor fails to correct the unsafe act or condition within the requested time frame, the District or its representative may have the condition
corrected and bill the non-compliant contractor, supplier, subcontractor, or installer for the costs associated with the correction.

5. The District may require a follow-up meeting or contact if there is a death, serious and willful claim, serious disabling injury, adverse loss experience, major fire, or serious third-party claim.

6. Any contractor displaying, in the opinion of the Contractor or District, a repeated disregard for safety can be removed from the Site.

D. All Contractors will advise those non-English speaking employees in their native language either in a written format or via an interpreter of these policies.

1.18 HAZARD COMMUNICATION PROGRAM SAFETY

A. Contractor shall have a copy of the Contractor’s Hazard Communication Program which shall be forwarded to the District and a copy is required to be in the possession of the Contractor on the Site. Documentation of employee Hazard Communication Training must be established by the Contractor prior to commencement of work.

B. Any potential hazardous material or chemical brought onto the project is required to be accompanied by a Material Safety Data Sheet (MSDS). Copies of the MSDS shall be forwarded to the District, and Project Inspector before the product is brought onto the Site.

C. Contractor is required to have material safety data sheets available in a readily accessible place at the Site for any material requiring a material safety data sheet per the Federal “hazard communication” standard, or employees’ “right-to-know law.” The Contractor is also required to properly label any substance brought into the Site, and require that any person working with the material, or within the general area of the material, is informed of the hazards of the substance and follows proper handling and protection procedures.

D. Contractor is required to comply with the provisions of California Health and Safety Code section 25249, et seq., which requires the posting and giving of notice to persons who may be exposed to any chemical known to the State of California to cause cancer. The Contractor agrees to familiarize itself with the provisions of this section, and to comply fully with its requirements.

E. Contractor shall notify the District and Project Inspector before any chemical/material creating noxious or toxic fumes is used.

1.19 SHORING AND STRUCTURAL LOADING

A. The Contractor shall not impose structural loading upon any part of the Work under construction or upon existing construction on or adjacent to the Site in excess of safe limits or loading such as to result in damage to the structural, architectural, mechanical, electrical, or other components of the Work.

B. The design of all temporary construction equipment and appliances used in construction of the Work and not a permanent part thereof, including, without limitation, hoisting equipment, cribbing, shoring, and temporary bracing of structural steel, is the sole responsibility of the Contractor. All such items shall conform with the requirements of
governing codes and all laws, ordinances, rules, regulations, and orders of all authorities having jurisdiction.

C. The Contractor shall take special precautions, such as shoring of masonry walls and temporary tie bracing of structural steel work, to prevent possible wind damage during construction of the Work. The installation of such bracing or shoring shall not damage the Work in place or the Work installed by others. Any damage which does occur shall be promptly repaired by the Contractor at no cost to the District.

D. The Contractor is required to provide shoring as required to protect existing buildings and other structures, such as, but not limited to, the Existing Library when the Contractor installs nearby new utilities. All shoring for existing structures shall be designed by a licensed California Structural Engineer and submitted to the District prior to any work occurring in the vicinity of the existing structure(s). Contractor shall also be responsible to place monitoring points on the Existing Library by a California Licensed Surveyor prior to the start of work to monitor any possible movement during the course of construction. Prior to, during and after nearby utilities have been installed, the Contractor’s California Licensed Surveyor shall survey the pre-established survey points to confirm the building did not move during the installation of the nearby utility work.

E. The Contractor is responsible to provide all temporary shoring for utility trenching activities, and other temporary shoring as required by law to install new improvements. All temporary shoring noted above shall be designed by a California Licensed Civil Engineer, other than the structural shoring required by a Licensed Structural Engineer in Paragraph 1.19D above.

1.20 SAFETY AND ELECTRICAL STANDARDS

A. The Contractor shall comply with all safety and electrical standards to ensure that all its employees are protected by Ground Fault Circuit interrupters as required, throughout the course of the Contractor’s work.

B. The Contractor is responsible for installation of any and all temporary power service for the project and shall provide it with Ground Fault Interrupter Protection with no additional cost to the District.

1.21 HAZARDOUS SUBSTANCES

A. No asbestos or asbestos-containing products shall be used in this construction or in any tools, devices, clothing, or equipment used to effect this construction. See Section 01412, Hazardous Materials and other related Contract Documents.

B. The Contractor shall not receive, use or store at the Site any hazardous substance unless contained in a container labeled with the original label applied by the Manufacturer of such substance. The Contractor shall maintain at the Site and forward to the District and Project Inspector copies of the most current material safety data sheets with respect to each hazardous substance received, used or stored at the Site by the Contractor.

C. The Contractor shall immediately forward to the District and Project Inspector any updated material safety data sheets.

D. The Contractor shall properly label and inform the District and Project Inspector of, any pipes or piping systems containing hazardous substances used or maintained at the Site.
by the Contractor. Prior to the receipt of such materials at the Site, the Contractor shall submit a list of all materials which the Contractor intends to receive, use or store at the Site that are classified as hazardous substances pursuant to applicable federal, state or local Employee or Community Right to Know statutes, regulations or requirements.

1.22 SAFETY SURVEYS

A. Inspector of Record may conduct periodic safety surveys of the Project. Any safety discrepancy observed will be reported to the appropriate Contractor Site Safety Representative for immediate correction.

B. District, Architect, and/or Inspector of Record safety surveys do not, without any limitation, relieve the Contractor of their primary responsibility to self-inspect the Work and equipment, and to conduct the Work in a safe manner.

C. Contractor shall provide the District, and Project Inspector with Monthly Contractor Accident Statistics Reports.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01540
SECTION 01552
GEOTECHNICAL REQUIREMENTS

1. General

1.1. These Geotechnical Requirements have been prepared for the purpose of bid and have been derived from the District’s soils report and updates prepared by RMA Group, dated October 21, 2016 and revised on December 8, 2016. Such reports have been submitted to the DSA as part of the Permit Set documents, and is available for inspection by the Contractor, but is not part of the Contract Documents and is made available solely for the convenience of the Contractor. The site plan showing the locations of borings, cone penetration tests (CPTS), and trenches and the logs of test borings, CPT profiles and trench logs showing a record of the data obtained by the District’s investigation of subsurface conditions is included in the above referenced report. These soils borings and logs are made available for the convenience of the Contractor, but are not part of the Contract Documents, but represent only the opinion of the District as to the character of the materials and ground water levels encountered on the date drilled/performed. The Contractor can only rely on the “technical data” as described in Section 00210, Paragraph 1.5.

1.2. This Specification Section includes the following:

1.2.1 Clearing, stripping, grubbing, and preparing areas to be filled

1.2.2 Selecting materials for fill

1.2.3 Placing, spreading, and compacting fill

1.2.4 Completing subsidiary work necessary to conform to lines, grades, and slopes shown on Contract Drawings

1.2.5 Protecting the soil in slab and foundation areas from drying out between grading and construction

1.3 Tests and observations shall be made by a representative from the Geotechnical Engineer (hereafter Geotechnical Engineer Representative) during grading so that the Geotechnical Engineer Representative can perform observations and tests to confirm that grading was performed according to the Drawings and Specifications of this Contract.

1.4 The Geotechnical Engineer Representative shall be notified at least two working days prior to placement of fill; so, arrangements for testing and observation can be made.

1.5 No grading operations and/or placement of fill performed by Contractor without inspection by the Geotechnical Engineer Representative will be accepted.

1.6 The Contractor shall anticipate encountering excessively over-optimum (wet) soil moisture conditions during winter or spring grading, during or following periods of rain, and/or due to
irrigation of adjacent areas. The Contractor shall mitigate wet soil conditions by any of the following as part of their original Contract Price:

1.6.1 Frequent spreading and mixing during warm dry weather;

1.6.2 Mixing with lime, lime-fly ash, or cement product, approved by the Geotechnical Engineer. However, none of these products are allowed to be used in any tree protection zones, or within twice the diameter of any tree protection zones shown on the drawings.

1.6.3 Mixing with lime, lime-fly ash, or cement product, approved by Geotechnical Engineer and the District’s Arborist;

1.6.4 Stabilizing with aggregate, geotextile stabilization fabric and/or geo-grid; shall be evaluated and approved by Geotechnical Engineer Representative.

1.7 When unfavorable weather conditions necessitate interrupting filling and grading operations, areas shall be prepared by compaction of surface and grading to avoid collection of water. Adequate temporary drainage shall be provided to prevent erosion. After interruption, compaction specified in last layer shall be verified or reestablished before resuming work.

2. Testing

2.1 The American Society for Testing and Materials (ASTM) Test Procedure D 1557- (latest revision) shall be the standard test to define maximum densities for all compaction of fill. All densities shall be expressed as relative compaction in terms of the maximum dry density obtained in the laboratory by the foregoing standard procedure.

2.2 Field density tests shall be performed according to ASTM Test Procedures D 6938-08A. The locations and number of field density tests shall be selected by the Geotechnical Engineer Representative.

3. Clearing, Stripping, Grubbing, and Subexcavation to Prepare Areas to be Filled

3.1 Trees, roots, vegetation, and organic surficial soil shall be removed from structural areas unless specified otherwise by the Geotechnical Engineer. The depth of organic surficial soil to be removed will be recommended by the Geotechnical Engineer Representative, but for purposes of the original Contract Price, should be estimated as 3 inches. Stripping shall extend a minimum of 5 feet laterally beyond building lines (defined as the outside perimeter of the building walls or footing outer limits, whichever results in the greatest building envelope, and 2 feet beyond flatwork and pavement, where feasible.

3.2 Strippings are defined as surface vegetation and organic surficial soil. Strippings may not be used in engineered fill unless specifically authorized and observed by the Geotechnical Engineer Representative. Stripping may be stockpiled for landscaping use, with the approval of the District and Architect.
3.3 Soil deemed soft or unsuitable by the Geotechnical Engineer Representative shall be removed. Loose fills and surface soil sloughs shall also be excavated.

3.4 Underground structures such as old foundations, abandoned pipelines, septic tanks, and leach fields shall be legally removed from the Site.

3.5 The final stripping and excavation shall be approved by the Geotechnical Engineer Representative before further grading is started.

3.6 Demolition and removal of the former foundations may result in disturbance to the subsoil to a depth of three (3) feet below previously existing slab or footings/grade beams (see recommendation in Geotechnical Report, Section 7.2). This disturbed zone must be properly recompacted in order to prepare a uniform compacted fill pad prior to placing new fill to establish the new building subgrade. The actual depth and lateral extent of the subexcavation required shall be determined in the field by the Geotechnical Engineer Representative.

3.7 The subexcavated subgrade soil to receive fill shall be moisture-conditioned and compacted to the following requirements:

- Minimum relative compaction: 90 percent
- Minimum moisture content: 2 percent over optimum

Scarification and moisture conditioning of intact rock areas may be waived by the Geotechnical Engineer Representative.

4. Selecting Fill

4.1 The Geotechnical Engineer shall evaluate suitability of materials for compacted fills. The material shall be a soil or soil-rock mixture, free of organic matter or other deleterious substances. Within 3 feet of finished grade, the compacted fill shall contain no rocks or lumps over 3 inches in diameter and none that are more than 15 percent larger than 2-1/2 inches. Rocks greater than 3 inches in diameter shall be placed in deep fills as approved by the Geotechnical Engineer Representative; so that they are not nested and so compaction may be achieved around them.

4.2 If imported materials are needed or desired by the Contractor, or when “non-expansive” fill is specified, they must be approved by the Geotechnical Engineer Representative prior to transporting the fill to the project. The proposed import fill shall be submitted to the Geotechnical Engineer for approval and appropriate testing no less than 5 working days before the expected delivery to the Site. Unless otherwise exempted by the Geotechnical Engineer, they shall meet the following requirements:

- 4.2.1 Must be granular in nature, with the Plasticity Index not exceeding 15 and having a Liquid Limit less than 30.
4.2.2 No rocks shall exceed 3 inches in diameter and at least 90% passing the 1-inch size. Percent passing the #200 Sieve is at least 8% and less than 40%.

4.2.3 The existing aggregate base, asphalt, and concrete (if broken up to meet the grading requirements in 4.2.2 may be used as general fill but shall not be used within the footprint of the new buildings without prior approval from the District and the Geotechnical Engineer Representative.

5. Placing, Spreading, and Compacting Fill

5.1 The fill shall be placed in uniform lifts of not more than 8 inches in uncompacted thickness. Each layer shall be spread evenly and shall be thoroughly blade mixed during spreading to obtain uniformity of material. Before compaction begins, the fill shall be brought to a water content (as directed by the Geotechnical Engineer Representative) that will permit required compaction by either (1) aerating the material if it is too wet, or (2) spraying the material with water if it is too dry.

5.2 After each layer has been placed, mixed, and spread evenly, it shall be compacted, except as noted for pavement subgrade (see Paragraph 10 in this specification section) as follows:

   Minimum relative compaction: 90 percent

   Minimum moisture content: 2 percent over optimum for clay soils and at near optimum moisture content for “Non-expansive” fill and granular soils.

5.3 The Contractor shall use appropriate equipment to compact the fill to the specified density. Compacting shall be performed while the fill is within the specified range of moisture content. Each layer shall be compacted over its entire area, and the compacting equipment shall make enough passes to achieve the required density.

5.4 Fill placed on slopes shall be compacted by means of suitable equipment. Benching of the slopes shall be done in increments of 3 to 5 feet in height until the fill is brought to its specified height, or as determined by the Geotechnical Engineer Representative. To permit proper compaction of the outer limits of fill slopes, the slopes should be over built about 1 foot horizontally and then cut back to grade.

5.5 When sheepfoot rollers are used for compaction, the density tests shall be taken in the compacted material below the surface disturbed by the roller. When these tests indicate that the density of any layer of fill, or portion thereof, is below the required density, it shall be reworked until the required compaction has been obtained.

5.6 Soil shall not be placed or compacted during periods of rain or on ground which is not drained of water. Soil which has been moistened by rain or other cause shall not be compacted until the moisture content is within the limits specified in Paragraph 5.2 above, or as approved by the Geotechnical Engineer Representative.
5.7 Proof-roll finish subgrade below the building slabs and pavements and where requested by the Geotechnical Engineer Representative, with a heavy pneumatic-tire (e.g. loaded water truck) to identify soft pockets and areas of excessive yielding. Do not proof-roll wet or saturated subgrade.

5.8 Building pad subgrade and foundation excavations require periodic moistening to prevent drying of the subgrade soil. The Geotechnical Engineer Representative must check moisture conditions in the subgrade soil and foundation excavations 48 hours prior to the placement of rock base or concrete.

6. **Backfilling Trenches**

6.1 Geologic exploratory trenches (or other depressions), if any, within the proposed building or pavement areas, shall be re-excavated and backfilled to meet the requirements for compacted fill, as specified above.

6.2 The utility trenches extending under the perimeter foundation and concrete slabs-on-grade require backfilling or plugging with impermeable soils at the building line and extending two feet into and beyond the building line. Trench backfill will be compacted to a minimum 90 percent relative compaction at a minimum of 2 percent over-optimum moisture content, except the upper 8-inches of backfill beneath pavement areas shall be compacted to a minimum of 93 percent relative compaction. Ponding (flooding) or jetting of trench backfill is not permitted.

6.2 Utility trenches that parallel the sides of the buildings shall be placed so that they do not extend below a line sloped down and away at a slope of 2H:1V (horizontal to vertical) from the bottom outside edge of the perimeter foundations (i.e., the base of the grade beam systems or the base of the exterior footings for the reinforced slab on grade floors).

6.3 Trench Excavation and Shoring: The Contractor shall provide the District and the Geotechnical Engineer with a letter identifying the company’s “Competent Person” overseeing excavation activities, and a copy of the company’s current OSHA permit. The Contractor shall also submit for approval a trench excavation safety plan conforming to Sections 5-1.02A and 7-1.01E of the California State Standard Specifications.

7. **Removing Subsurface Pipes**

7.1 The Geotechnical Engineer Representative shall designate the methods of removal of subsurface pipes. Depending upon depth and location, one of the following methods shall be specified:

7.1.1 Pipes larger than 6 inches in inside diameter or as shown on the Drawings shall be removed, and the trench shall be filled and compacted according to applicable requirements for compacting native soil (Paragraph 3 of this specification section) or fill (Paragraph 5 of this specification section).
7.1.2 Pipes less than 6 inches in diameter may be left in place unless they interfere with new construction provided, they are filled with a sand cement slurry or cement grout.

7.2 If discovered as a differing site condition, any existing wells on the Site shall be filled, buried and capped according to the requirements of the local regulatory agency. The final elevation of the top of the well casing shall be a minimum of 36 inches below any adjacent grade at the completion of grading or filling. Under no circumstances should structural foundations be placed over the capped wells unless otherwise permitted by the Geotechnical Engineer Representative.

8. Grading Slopes

8.1 Slopes shall be graded at gradients no steeper than 2:1 (horizontal to vertical) for fill and cut, unless approved by the Geotechnical Engineer Representative.

8.2 After the slopes have been graded, they shall be track-rolled, and provisions shall be made for planting the slopes for erosion control. Drainage facilities shall be constructed to prevent water from flowing over slopes. No slope shall be left to stand through a winter season without erosion control.

9. Installing Subdrains

9.1 For subdrains, the contractor shall provide and install perforated pipe Standard Designation Ratio (SDR) 23.5 or equivalent approved by the Geotechnical Engineer and filter material for subdrains as shown on the Drawings or as directed by the Geotechnical Engineer. The following restrictions apply:

9.1.1 Clay drain tile, concrete drain tile and perforated clay pipe shall not be permitted. Use no wyes, tees, or other joints of these materials.

9.1.2 Porous concrete pipe, perforated asbestos-cement pipe, bituminous fiber or pipe of other materials shall be permitted only on written authorization of the Geotechnical Engineer.

9.1.3 The Contractor shall use Caltrans Class 2 permeable material, or as otherwise approved by the Geotechnical Engineer. Where the use of 1/2 by 3/4-inch drain rock is allowed, it must be wrapped within a filter fabric approved by the Geotechnical Engineer, unless otherwise permitted by written authorization from the Geotechnical Engineer. Filter fabric is not needed if Caltrans Class 2 permeable material is used.

9.1.4 Unless recommended otherwise by the Geotechnical Engineer Representative, the Contractor shall use pipes not less than 4 inches in diameter for lateral drains up to 50 feet in length. Use pipes of not less than 6 inches in diameter for lateral drains greater than 50 feet in length. Larger minimum pipe diameters may be specified by the Geotechnical Engineer during construction.
9.1.5 All retaining walls must be drained by providing a perforated horizontal pipe (SDR 35, or equivalent) behind the wall or other method deemed acceptable by the Geotechnical Engineer. The subdrain pipe must be placed no greater than 2 inches off the bottom of a gravel drain placed at the top of the heel of the wall footing and drained to an acceptable outlet. The subdrain pipe must be a minimum of 4-inches in diameter and lie at a minimum 1 percent slope gradient. The minimum 12-inch gravel drain composed of Caltrans Class 2 permeable material shall extend to within 18-inches of the surface, with the remainder of backfill consisting of compacted, relatively impervious, native soil material.

10. **Pavement**

10.1 The original ground on which the fill and pavement section are to be placed shall be plowed or scarified at least 12 inches and until the surface is free from ruts, hummocks or uneven features, which would tend to prevent compaction. The pavement sections presented in the Drawings and Specifications are preliminary and are subject to modification based on the results of R-value tests performed on the subgrade soils after grading is completed. The pavement section requires the following construction criteria:

10.1.1 Remove organic and deleterious materials from all pavement subgrade. Areas of existing asphaltic concrete section that are disturbed from existing tree roots may require additional subexcavation and recompaition, and even the placement of subgrade stabilization geotextile fabric in order to provide a stable subgrade.

10.1.2 Moisture condition the upper 12 inches of subgrade soil and compact it to a minimum relative compaction of 95 percent and to a moisture content of at least 2 percent over the optimum moisture content. All pavement subgrade should be stable with no “pumping” at the time the base rock is placed and will be “proof-rolled under as requested and under the review of the Geotechnical Engineer.

10.1.3 Use only good quality materials of the type and minimum thickness specified. All baserock shall meet the Caltrans Standard Specifications for Class 2 baserock and should be angular in shape.

10.1.4 Compact the baserock uniformly to a minimum relative compaction of 95 percent.

10.1.5 Place the asphaltic concrete only during periods of fair weather and not raining when the free air temperature is within the prescribed limits as set forth by the Asphalt Concrete Institute.

10.1.6 Compact all trench backfill under the pavement to reduce fill settlement and minimize pavement damage that may result from such settlement. Mechanical compaction is required. Compaction by jetting or ponding is not permitted.

10.1.6 Provide adequate drainage or V-ditch systems to prevent surface water from migrating into the subgrade pavement soil from behind curb-and-gutter sections.
areas where pavement abuts landscaping, the concrete curb shall be extended a minimum of 2 inches below the base of the baserock to form a cut-off wall to prevent water from migrating into the baserock.

11. **Dewatering**

11.1 The Contractor shall anticipate the need to dewater the Site and therefore, dewatering equipment necessary to drain and keep excavations free of water under all circumstances shall be provided, operated, and removed by the Contractor when work is completed.

11.2 Contractor shall obtain the Geotechnical Engineer’s approval of the proposed method of dewatering, and comply with all requirements, including the payment of any fees or charges by the City of San Pablo or agency having jurisdiction, and to legally dispose of surface and groundwater.

11.3 Surface water shall be prevented from flowing into the excavations. Accumulated water shall be promptly removed.

11.4 Dewatering systems shall be maintained in-place until construction work below groundwater level is completed.

12. **Foundations**

12.1 Foundation excavations shall be per the lines and grades shown on the Drawings.

12.2 The Geotechnical Engineer Representative must review the foundation excavation for acceptance prior to the placement of reinforcement steel. Where the bearing soils are determined to be too soft, overexcavation and replacement with lean concrete or compacted engineered fill will be required.

12.3 The Geotechnical Engineer Representative must determine if bearing soils are at an acceptable moisture condition. Moisture condition includes drying soils that are too wet and adding water to soils that are too dry.

13. **Unusual Conditions**

13.1 If unusual conditions occur during grading, the Geotechnical Engineer shall be immediately notified for recommendations.
SECTION 01572
STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED DOCUMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01010 – “Summary of Work”
B. Section 01050 – “Field Engineering”
C. Section 01330 – “Submittal Procedures”
D. Section 01410 – “Regulatory Requirements”
E. Section 00700 - General Conditions Article 13.12, Storm Water Pollution Prevention
F. Divisions 2 through 33 Sections for Storm Water Prevention Plan requirements for the work in those sections.

1.3 BACKGROUND

A. Storm drains discharge directly to creeks and the Bay without treatment. Discharge of pollutants (any substance, material, or waste other than uncontaminated storm water) from this project into the storm drain system is strictly prohibited by the State Water Resources Control Board (SWRCB) Order 2009-0009 DWQ (Order) and California Regional Water Quality Control Board (RWQCB) Water Quality Control Plan San Francisco Bay Basin Plan (Basin Plan).

B. This specification is applicable to this Project since it will disturb (e.g., digging, trenching, grading, clearing, filling) one or more acres of land surface. Contractor shall calculate and confirm the disturbed soil acreage and submit calculations to the District.

C. This specification also covers Linear Underground/Overhead Projects as regulated by the Order.
D. Area of land surface disturbance includes but is not limited to:
   1. Clearing of the land both for access (i.e. access roads) to the site as well as preparing the site for constructing the project,
   2. Constructing access roads to the Site,
   3. Grading of the Site in total,
   4. Equipment staging area, maintenance area, and construction easement if they occur atop a
soil surface which has not been included in the calculation for area of soil disturbance,
5. Material and/or soil stockpiles if atop a soil surface (not if atop an impervious surface such as concrete or asphalt),
6. Area of asphalt or concrete pavement removal if it is removed entirely to the soil surface,
7. Area that is related to demolition and removal of existing structures if that demolition and removal is to the soil surface.
8. Concrete truck clean-out areas if atop a soil surface.

1.4 SUMMARY OF WORK
A. Provide storm water pollution prevention plan as specified and as required by appropriate regulatory authorities, complete.
B. Work In this section includes all labor, equipment, and materials necessary for the preparation, implementation, maintenance, and monitoring of the Storm Water Pollution Prevention Plan (SWPPP). Principal items of work included herein include, but are not limited to:
   1. Plan administration, maintenance, update, and termination.
   2. Placement of erosion/pollution control devices (where applicable).
   3. Maintenance and monitoring of control devices.
   4. Miscellaneous related work necessary for plan compliance.
   5. Reports and certificates.
C. Work under all other sections of this specification shall comply with the requirements of this section. All trades working on the Project need to be aware of and in compliance with the SWPPP.
D. All materials that can potentially enter and/or pollute storm water discharges and the generation of non-storm water discharges shall be in compliance with the SWPPP. Representative materials and procedures include erosion control of construction vehicles and equipment, and general construction debris potentially entering the storm drain system's natural flow course.

1.5 REQUIREMENTS
A. The State Water Resources Control Board uses the Storm Water Multiple Application and Report Tracking System (SMARTS) SMARTS web based application for storm water permit processing and tracking. The Contractor shall input data and upload documents required for storm water permit compliance. The program is also responsible for processing, reviewing, updating, terminating Notices of Intent (NOIs), annual reports, and maintaining the billing status of each discharger. SMARTS has been developed to provide an online tool to assist dischargers in submitting their NOIs, NECs, NOTs, and Annual Reports, as well as, viewing/printing Receipt Letters, monitoring the status of submitted documents, and viewing their application/renewal fee statements. The system will also allow the Regional Board and State Board staff to process and track the discharger submitted document is a user account and password protected system where a valid user account and password is needed to access the system. Prepare Permit Registration Documents according to the requirements found in this section. Electronically submit these documents to the District at least 15 working days prior to the land surface disturbance at the Site. Once the documents.

SMARTS is a user account and password protected system where a valid user account and
password is needed to access the system. Prepare Permit Registration Documents according to the requirements found in this section. Electronically submit these documents to the District at least 15 working days prior to the land surface disturbance at the Site. Once the documents are approved, the Contractor shall upload the required data and documents to the SMARTS web site.

B. Provide a Qualified Storm-Water Pollution Prevention Plan (SWPPP) Developer (QSD) and a Qualified SWPPP Practitioner (QSP) for SWPPP development and implementation as defined in the Order ("Qualified" means the developer and/or practitioner possesses the necessary professional license, i.e. Professional Engineer, Geologist, etc. and has passed any exam(s) required to obtain the QSD/QSP certification. Refer to the specific requirements as shown within the SWRCB General Construction Permit and regulations). The QSD or QSP shall input and maintain data and documents in the SMARTS web site to ensure compliance with the state storm permit at all times.

C. Provide all material, labor, equipment, for installation, implementation, and maintenance of all surface-water pollution prevention measures. This work includes the following:

1. Furnishing, placing, and installing effective measures for preventing erosion and runoff of soil, silts, gravel, hazardous chemicals or other prohibited materials defined by the SWRCB and RWQCB.
2. Managing on-site construction materials in such a manner as to prevent said materials from contacting storm water or wash water and running off-site into the storm drain system.
3. Complying with applicable standards and regulations for water pollution and erosion control.
4. Include post-construction storm water pollution prevention structures in the storm water pollution prevention plan. Contractor shall use construction drawings as the reference for post-construction BMPs.

D. Contractor will not be required to maintain post-construction pollution prevention structures. However, Contractor is required to provide operations and maintenance documents to the District at the end of construction.

E. In this section, the term "storm drain system" shall include storm water conduits, storm drain inlets and other storm drain structures, street gutters, channels, watercourses, creeks, lakes, and the San Francisco Bay.

F. Sanitary sewer discharge regulations are intended to provide protection of the sanitary sewer system and appropriate municipal utility water pollution control plant. In this specification, “sanitary sewer” shall include any sanitary sewer manhole, clean-out, side sewer or other connection to the area wastewater treatment plant.

G. Contractor shall have storm drain pollution prevention measures in place and follow this specification anytime rain is predicted in the San Francisco Bay Area by the National Oceanic and Atmospheric Administration (NOAA) prediction for rain at or above 50%. It is the responsibility of the Contractor to be prepared for a rain event at all times required by the Order, to be aware of weather predictions, and to perform actions triggered by prediction of such rain events. The District is not responsible for informing the Contractor of rain predictions. In the event the Project is determined to be a Risk Level two or higher project by the Contractor’s QSD/QSP, the Contractor must create a Rain Even Action Plan (REAP) anytime rain is predicted (50% or greater chance as mentioned above) within 48 hours. The QSP must
implement the REAP and have it on-site no later than 24 hours prior to the rain event.

H. Construction site sanitary sewer blockage will likely result in a back-up and overflow to the storm drain system. The Contractor shall immediately notify the District and the Project Inspector of record if there is a clogged sanitary sewer, and implement a plan to re-direct sewage if an overflow of the sanitary sewer will result in sewage discharge to the storm drain.

 Contractor shall not allow any non-storm water to enter the storm drain system. Non-storm water includes domestic supply water used to wash streets, painting and drywall equipment, tools, equipment, or vehicles. Except for certain fire-line flushing and testing procedures, contact the District for discharge approval.

1.6 REGULATIONS AND STANDARDS
A. Contractor shall comply with the following applicable regulations:
   2. “San Francisco Bay Basin (Region 2) Water Quality Control Plan” (Basin Plan), California Regional Water Quality Control Board,
   3. California State Water Resources Control Board NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) GENERAL PERMIT FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION AND LAND DISTURBANCE ACTIVITIES, Order 2009-0009 DWQ (Order) and all Amendments.
B. Contractor shall comply with industry-standard guidelines on storm drain pollution prevention, such as:
   1. “Erosion and Sediment Control Field Manual” California Regional Water Quality Control Board (RWQCB)—San Francisco Bay Region.

1.7 SUBMITTALS/DELIVERABLES
A. Prepare Permit Registration Documents (PRD) according to the requirements found in Attachment B of the Order. Submit these documents to the District electronically at least 20 working days prior to the soil disturbance at the Site. Some or all of the following documents may be required, depending on the site Risk calculation, monitoring requirements, construction phase storm water treatment systems, and post-construction storm water treatment structures:
   1. Storm Water Pollution Prevention Plan created by the Contractor’s QSD
   2. Site Map
   3. Post-construction water balance form
   4. Risk Calculation
   5. Active Treatment Systems plans (based on Risk Level determined in PRD)
   6. Others as may be required by the State Water Resources Control Board Order 2009-0009 DWQ.
   7. Erosion control and water pollution control drawings based on actual construction phasing and staging locations. Contractor shall use construction drawings and requirements from the construction general permit as the reference for these drawings.
B. The Notice of Intent (NOI) will be completed by the District following electronic upload of the
C. Monitoring Reports. Monitoring sampling results reports are mandated according to the Risk Level and specific characteristics of the Site as prescribed in the Order. Contractor shall determine the required monitoring reports according to the Order and submit a list of such documents to the District and the SMARTS database. When the Project is underway, the Contractor shall produce the mandated reports electronically and submit them to the District and SMARTS electronically within 2 days of the conclusion of the rain event, and within 1 day of Numeric Action Level exceedance.

D. Annual Reports. Contractor shall determine the required information according to the Order and electronically submit the Annual Report electronically to the District and the SWRCB via SMARTS database.

E. Notice of Termination. Contractor shall determine the required information according to the Order and electronically submit Notice of Termination documents to the District and the SWRCB via the SMARTS database.

F. Complete and provide the Post-Construction Water Balance Performance Standard Spreadsheet as found in Appendix 2/2.1 of the Order.

1.8 ENVIRONMENTAL ENFORCEMENT

A. State, regional, and local agencies have authority to enforce, through codified regulations, any portions of this Section that if not implemented may violate applicable regulations. Agency enforcement may include but is not limited to: citations, orders to abate, bills for cleanup costs and administration, civil suits, and/or criminal charges. Contract compliance action by the District shall not be construed to void or suspend any enforcement actions by these or other regulatory agencies.

PART 2 - MATERIALS

2.1 GENERAL

A. Provide materials as required for execution of the Work required by the approved Stormwater Pollution Prevention Plan prepared by the Contractor’s QSD

PART 3 - EXECUTION

3.1 GENERAL

A. Report any hazardous or unknown material spills immediately to a District Representative. If a spill occurs after hours or on a weekend, contact the campus Police Department. The Contractor is responsible for ensuring that its employees and subcontractors (if any) working on site are aware of the location of the campus phone nearest the Site. The Contractor is also responsible for creating the necessary spill reports outlined in the construction general permit and must upload them to SMARTS.

B. Adhere to the requirements of the Order.

3.2 SPILL PREVENTION AND CONTROL
A. The Contractor shall keep spill cleanup materials, such as rags or absorbents, readily accessible on-site.
B. The Contractor shall immediately contain and prevent leaks and spills from entering storm drains, and properly clean up and dispose of the waste and cleanup materials. If the waste is hazardous, the Contractor shall dispose of hazardous waste only at authorized and permitted Treatment, Storage, and Disposal Facilities, and use only licensed hazardous waste haulers to remove the waste off-site, unless quantities to be transported are below applicable threshold limits to transportation specified in State and Federal regulations.
C. The Contractor shall not wash any spilled material into streets, gutters, storm drains, or creeks and shall not bury spilled hazardous materials.
D. The Contractor shall report any hazardous materials spill to Emergency 911.

3.3 DE-WATERING AND SEDIMENT MANAGEMENT AND NONHAZARDOUS MATERIAL/WASTE MANAGEMENT

A. If storm water or groundwater in site excavations or drilled holes, (e.g., trenches, pits, pier holes, footings), needs to be removed, it shall be made clean by filtering, settling, or other method capable of removing solids and suspended particles from this water prior to discharge to the storm drain system. The Contractor shall ensure that this discharge complies with all applicable provisions of the Basin Plan.
B. If excavation water is domestic supply water, or the water is contaminated with a hazardous substance, then the Contractor shall dispose of according to guidance from the District. For disposal authorization, the Contractor shall contact the District to determine the discharge requirement.
C. If the Contractor suspects the presence of contaminated groundwater, or domestic supply water, the Contractor shall immediately notify the District. The Contractor shall not attempt to pump out or treat any material suspected of containing a hazardous material or petroleum product.
D. Designated Area:
   1. The Contractor shall propose designated areas of the Site, for approval by the Engineer, suitable for material delivery, storage, and waste collection that, to the maximum extent practicable, are near construction entrances and away from catch basins, gutters, drainage courses, and creeks.
E. Granular Material:
   1. The Contractor shall store granular material at least ten feet away from catch basin and curb returns.
   2. The Contractor shall not allow granular material to enter the storm drains or creeks.
   3. When rain is forecast within 24 hours or during wet weather, the Engineer shall require the Contractor to cover granular material with a tarpaulin and to surround the material with sand bags.
F. Dust Control: The Contractor shall use reclaimed water if available to control dust on a daily basis or as directed by the QSP. If reclaimed water is not available, Contractor to use domestic water.

3.4 HAZARDOUS MATERIAL/WASTE MANAGEMENT

A. Label all hazardous materials and hazardous wastes (such as pesticides, paints, thinners, solvents, fuel, oil, and antifreeze) in accordance with City, State and Federal regulations.
B. Store hazardous materials and wastes in secondary containment and cover them during wet weather.
C. Follow manufacturer’s application instructions for hazardous materials and do not use more than necessary. Do not apply chemicals outdoors when rain is forecast within 24 hours.
D. Arrange for appropriate disposal of all hazardous waste.
E. See Specification Section 01412, Hazardous Materials for more information and requirements.

3.5 SANITARY SEWER DISCHARGE POINT IDENTIFICATION
A. If the Contractor will be disposing of water from a settling operation, or any other water approved by the District for sanitary sewer disposal, the Contractor will verify with the Buildings and Grounds Department that the manhole used for disposal is a sanitary sewer and not a storm drain. (Note: do not assume that a manhole is a sanitary sewer, even if the words “sanitary sewer” is embossed on it. Sometimes utility maps and manhole cover designations are incorrect.)

3.6 WATER MAIN AND SANITARY SEWER LINE BREAK CONTINGENCY PLAN
A. If working on or near a water main line or sanitary sewer line, the Contractor shall have a written emergency response plan that states procedures for responding to a break and release of supply water to the storm drain system. This plan shall be made part of the SWPPP. The Contractor shall meet the following requirements:

1. Water Main Work
   a. Determine the direction of water flow if the main were to break.
   b. Build a containment berm between the work area and the storm drain inlet(s) that the water would flow into. Make the containment structure large enough to hold the water so that it can be pumped to a sanitary sewer.
   c. Build this containment structure before digging.
   d. If there is a water main break, pump the water that collects in the containment structure to a sanitary sewer.
   e. If the containment fails, prevent chlorinated water from entering the storm drain system.
   f. Put in place, before digging, sediment control structures upstream of drain inlets and at drain inlets.
   g. If a break occurs, contact the District and Project Inspector of record immediately.
      Include in the plan the phone numbers of the District and Project Inspector contact information.

2. Sanitary Sewer Line Work.
   a. Determine where the sewage will flow if the work could cause a blockage.
   b. Build a containment structure between the work area and the storm drain inlet(s) that the sewage water would flow into. Make the containment structure large enough to hold the sewage flow so that it can be pumped to a sanitary sewer.
   c. Build the containment before working on the sewer line. Put in place, before digging, solids (toilet paper, etc.) control structures upstream of drain inlets and at drain inlets.
   d. If a sewage blockage occurs, pump it to a sanitary sewer, and do not allow it to flow into the storm drain system.
   e. If the containment fails, prevent chlorinated water from entering the storm drain system by placing dechlorination sodium sulfite tablets in the sewage according to
Attachment 2 of this Section).
f. If a sewage blockage or spill occurs contact the District and Project Inspector of record immediately.

3. Excavation Work. This Paragraph applies to Contractors that excavate in the vicinity of sanitary sewer lines and cause or discover a sewage spill, leak or blockage.
   a. Immediately notify the District. The District will immediately notify Project Inspector. Include in the plan the phone numbers of the District and Project Inspector contact information.

3.7 PAVING OPERATIONS

A. Project Site Management:
   1. When rain is forecast within 24 hours or during wet weather, the District or the QSP may prevent the Contractor from paving.
   2. The QSP may direct the Contractor to protect drainage courses by using control measures, such as earth dike, straw bale, straw wattles, and sand bag, to divert runoff or trap and filter sediment.
   3. The Contractor shall place drip pans or absorbent material under paving equipment when not in use.
   4. The Contractor shall cover catch basins and manholes when paving or applying seal coat, tack coat, slurry seal, or fog seal.
   5. If the paving operation includes an on-site mixing plant, the Contractor shall comply with the County’s General Industrial Activities Storm Water Permit requirements.

B. Paving Waste Management: The Contractor shall not sweep or wash down excess sand (placed as part of a sand seal or to absorb excess oil) into gutters, storm drains, or creeks. Instead, the Contractor shall, either collect the sand and return it to the stockpile or dispose of it in a trash container. The Contractor shall not use water to wash down fresh asphalt concrete pavement.

3.8 SAW CUTTING

A. During saw cutting, the Contractor shall cover, or barricade catch basins using control measures, such as filter fabric, straw bales, sand bags, and fine gravel dams, to keep slurry out of the storm drain system. When protecting a catch basin, the Contractor shall ensure that the entire opening is covered.

B. The Contractor shall vacuum saw cut slurry and pick up the waste prior to moving to the next location or at the end of each working day, whichever is sooner.

C. If saw cut slurry enters catch basins, the Contractor shall remove the slurry from the storm drain system immediately.

3.9 CONTAMINATED SOIL MANAGEMENT

A. The Contractor shall look for contaminated soil as evidenced by site history, discoloration, odor, differences in soil properties, abandoned underground tanks or pipes, or buried debris. If the Project is not within an area of known soil contamination and no evidence of soil contamination is found, then testing of the soil shall only be required if directed by the District.

B. If the Project is within an area of known soil contamination or evidence of soil contamination is found, then soil from grading or excavation operations shall be tested by the District’s testing agency. The soil shall be managed as required by designated agency.
3.10  **ONCRETE, GROUT, AND MORTAR WASTE MANAGEMENT**

A. Material Management: The Contractor shall store concrete, grout, and mortar away from drainage areas and ensure that these materials do not enter the storm drain system.

B. Concrete Truck/Equipment Wash Out:
   1. The Contractor shall not be out concrete trucks or equipment into streets, gutters, storm drains, or creeks.
   2. The Contractor shall perform washout of concrete trucks or equipment off-site.

3.11  **PERSONNEL TRAINING**

A. The Contractor shall train its employees working on the Site on the requirements contained in this Section. The Contractor shall document this training in writing. District representatives for the Site will request to see the training materials and records at the onset of work.

B. The Contractor shall inform all subcontractors (if any) of the water pollution prevention requirements contained in this specification and include appropriate subcontract provisions to ensure that these requirements are met.

3.12  **LIST OF CONTRACTORS DESIGNATED SWPPP CONTACTS AND PHONE NUMBERS**

A. Provide a list of employees that will be responsible for preparing, implementing and updating the SWPPP, including, but not limited to, the name of the Contractor’s QSD and the Contractor’s QSP

**END OF SECTION 01572**
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED DOCUMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01010 – “Summary of Work”
B. Section 01030 – “Alternates”
C. Section 01400 – “Quality Control Requirements”
D. Section 01625 – “Product Options and Substitutions”
E. Section 01770 – “Contract Closeout Procedures”
F. Divisions 2 through 33 Sections for Basic Product Requirements for the Work in those Sections.

1.3 SUMMARY

A. This Section describes the basic requirements for the selection, handling, and storage of products to be used in the Project.

1.4 PRODUCTS

A. All products are to be new and not previously incorporated into or used in any other project or facility. Products salvaged or recycled from other projects are not considered new products and are not permitted.
B. The term product, as used in the Contract Documents, includes materials, equipment, systems, and like terms of similar intent.
C. Products include materials, machinery, components, equipment, fixtures and systems forming the Work and purchased for incorporation into the Work.
D. Products do not include machinery and equipment used for preparation, fabrication, conveying and erection of the work. Products may also include existing materials or components required for reuse.
E. Do not reuse materials and/or equipment removed from existing premises except as specifically permitted by the Contract Documents.
F. Provide interchangeable components of the same manufacturer, for similar components.
G. Named products are items identified in the Contract Documents by manufacturer’s product name, including make or model number or other designation shown or listed in manufacturer’s published product literature that is current as of date of the Contract Documents.
1.5 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer’s instructions.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, and/or other damage.

1.6 SHIPPING REQUIREMENTS

A. Preparation for Shipment: All equipment shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept dry at all times.

B. Painted and coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted and coated surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of District at the expense of Contractor. Any refinished items shall carry the warranty specified in the Contract Documents for new items.

C. Grease and lubricating oil shall be applied to all bearings and similar items.

D. Identification: Before shipping, each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Store products only in staging area per provisions of the Contract Documents.

B. Handle, store, and protect products in accordance with manufacturer’s instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.

C. For exterior storage of fabricated products, place on appropriate supports, above ground.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

H. Deliver, store and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer’s written instructions.

I. Schedule product deliveries to minimize long-term storage at the Site and to prevent overcrowding of construction spaces.

J. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
K. Deliver products to Site in an undamaged condition in manufacturer’s original sealed container or other packaging system, complete with intact and legible labels and instructions for handling, storing, unpacking, protecting, and installing.

L. Contractor shall comply with the following without limitation:

1. Contractor shall bear the responsibility for delivery of equipment, spare parts, special tools, and materials to the Site and shall comply with the requirements specified herein and provide required information concerning the shipment and delivery of the materials specified in the Contract Documents. These requirements also apply to any sub-suppliers making direct shipments to the Site. Acceptance of the equipment shall be made only after it is installed, tested, placed in operation and found to comply with all the specified requirements.

2. All items shall be checked against packing lists immediately on delivery to the Site for damage and for shortages. Damage and shortages shall be remedied with the minimum of delay.

3. No metalwork (including miscellaneous steel shapes and reinforcing steel) shall be stored directly on the ground. Masonry products shall be handled and stored in a manner to hold breakage, chipping, cracking, and spilling to a minimum. Cement, lime, and similar products shall be stored off the ground on pallets and shall be covered and kept completely dry at all times. Pipe fittings and valves may be stored out of doors but must be placed on wooden blocking. PVC pipe, geo-membranes, plastic liner, and other plastic materials shall be stored off the ground on pallets and protected from direct sunlight.

4. Electrical equipment and all equipment with antifriction or sleeve bearings shall be stored in weather-tight structures maintained at a temperature above 60 degrees Fahrenheit. Electrical equipment controls and insulation shall be protected against moisture and water damage. All space heaters furnished in or with equipment shall be connected and operated continuously or according to manufacturer’s requirements.

5. Equipment having moving parts such as gears, bearings, and seals, shall be stored fully lubricated with oil, grease, etc., unless otherwise instructed by the manufacturer. Manufacturer’s storage instructions shall be carefully followed.

6. When required by the equipment manufacturer, moving parts shall be rotated a minimum of twice a month to ensure proper lubrication and to avoid metal to metal “welding”. Upon installation of the equipment, Contractor shall, at the discretion of District, start the equipment at one-half load for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

7. When required by the equipment manufacturer, lubricant shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment by Contractor at the time of acceptance.

8. Equipment and materials shall not have any pitting, rust, decay, or other deleterious effects of storage when installed in the Work.

9. In addition to the protection specified for prolonged storage, the packing of spare units and spare parts shall be as for export packing and shall be suitable for long-term storage in a damp location. Each spare item shall be packed separately and shall be completely identified on the outside of the container.
10. Handling: Stored items shall be laid out to facilitate their retrieval for use in the Work. Care shall be taken when removing the equipment for use to ensure the precise piece of equipment is removed and that it is handled in a manner that does not damage the equipment.

11. Store products to allow for inspection, measurement, and/or counting of units.

12. Store materials in a manner that will not endanger adjacent Work.

13. Store products that are subject to damage by the elements, under cover in a weather-tight enclosure above ground, with ventilation adequate to prevent condensation.

14. Store cementitious products and materials on elevated platforms.

15. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

16. Comply with product manufacturer’s written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

17. Protect stored products from damage.

18. Protect liquids from freezing.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION 01610
SECTION 01625
PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01311 – “Project Management and Coordination”
C. Section 01400 – “Quality Control Requirements”
D. Section 01610 – “Basic Product Requirements”
E. Section 01722 – “Execution Requirements”
F. Section 01780 – “Project Record Documents”
G. Division 2 through 33 Sections for specific requirements for Materials and Equipment (Product Options and Substitutions) for the work in those Sections.

1.3 SUMMARY
A. This Section includes administrative and procedural requirements concerning product options and substitutions.

1.4 GENERAL
A. The term product, as used in the Contract Documents, includes materials, equipment, systems, and like terms of similar intent.
B. All products are to be new and not previously incorporated into or used in any other project or facility. Products salvaged or recycled from other projects are not considered new products and are not permitted.
C. Named products are identified in the Contract Documents by manufacturer’s product name, make or model number, and/or other specific designation.
   1. Do not use materials and/or equipment removed from existing premises, except as specifically permitted by the Contract Documents.
D. List of Manufacturers and Products Required. The Contractor shall require all Subcontractors to prepare and submit to the Contractor, within thirty (30) days of execution of the Subcontract, four (4) copies of the comprehensive lists of manufacturers and products proposed for the Project, including information on materials, equipment, and fixtures required by the Contract Documents, as may be required for the Contractor’s or Architect’s approval.
   1. Approval of such lists of products shall not be construed as a substitute for the shop drawings, manufacturer’s descriptive data, and samples, required by the Contract
1.5 PRODUCT SELECTION AND SUBSTITUTION REQUIREMENTS

A. Substitutions are defined as any changes in products, materials, equipment, and/or methods of construction from those required by the Contract Documents, and that are proposed by the Contractor.

B. When only one product is specified, and unless the Specifications state that no substitution is permitted, whenever the Contract Documents indicate any specific article, device, equipment, product, material, fixture, patented process, form, method, or type of construction or any specific name, make, trade name, or catalog number, with or without the words “or equal,” such specification shall be deemed to be used for the purpose of facilitating description of the material, process, or article desired and shall be deemed to be followed by the words “or equal” unless the Contract Documents specify “no substitution allowed”, “no equal”, “no equivalent”, “to match campus standard”, “single source,” or other language with similar meaning, in which case no substitutions will be allowed.

1. Pursuant to Paragraph 3.11.4 of the General Conditions, the apparent lowest responsive and responsible bidder may, within three (3) work days after bid opening offer any material, process, article, etc., which shall be materially equal or better in every respect to that so indicated or specified (“Specified Item”) and will completely accomplish the purpose of the Contract Documents.

C. For products specified by naming only one manufacturer and including the words “no substitutions allowed”, “no equal”, “to match campus standard”, “single source” and/or other phrase with similar meaning:

1. There is no product option due to necessity to match existing products or systems, to meet other design criteria or dependencies, or to comply with established standards. No substitution will be allowed.

2. If product becomes unavailable due to no fault of Contractor, submit Request for Substitution, including all information required herein.

D. When more than one product is specified, and in the absence of language stating “no substitutions allowed”, “no equal”, “to match campus standard”, “single source,” or other phrase with similar meaning:

1. Select products of any named manufacturer meeting all specified requirements or submit a request for substitution at time of bid.

2. If product becomes unavailable due to no fault of Contractor, submit Request for Substitution (RFS), including all information required herein.

E. For products specified by naming one or more products followed by the words “or approved equal”:
1. Select products of any named manufacturer meeting all specified requirements or submit a request for substitution at time of bid.

F. For products specified only by reference standard, select any product meeting or exceeding all requirements of the specified standard.

G. Compatibility of product options: If Contractor is given an option of selecting between two or more products for use on the Project; product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Contractor shall be responsible for providing products and construction means and methods that are compatible with the products and construction means and methods of other contractors.

H. Products Specified which are Commercially Unavailable. If the Contractor fails to make a request for substitutions for products, at the time of submitting bids to the District, and such products subsequently become commercially unavailable, the Contractor may request a substitution for such commercially unavailable item.

1. The decision to grant this request is solely at the District’s discretion. The written approval of the District, consistent with the procedure for Change Orders, shall be required for the use of a proposed substitute material.

2. The District may condition its approval of the substitution upon the delivery to District of an extended warranty or other assurances of adequate performance of the substitution as well as an equitable deduction in the contract price should the substituted item cost less than the Specified Item.

3. All risks of delay due to the approval of a requested substitution by the DSA, or any other governmental agency having jurisdiction, shall be on the requesting party. All additional costs, all procurement and construction delays, and all costs for review by the Architect or its consultants shall be the responsibility of the Contractor and will be deducted from Contractor’s pay request.

I. Substitution Request Form. All requests for substitutions of products, materials, or processes in place of a Specified Item must be submitted in writing on the District’s Substitution Request Form ("Request Form") within three (3) work days after bid opening. The Request Form must be accompanied by evidence as to whether the proposed substitution meets the requirements of the Contract Documents as specified herein.

J. After bids are opened, the apparent lowest responsive and responsible bidder shall provide, within three (3) days of opening such bids, any and all Drawing, Specifications, samples, performance data, calculations, and other information, as required herein to assist the Architect and the District in determining whether the proposed substitution is acceptable. The burden of establishing these facts shall be upon the bidder.

K. After the District’s receipt of such evidence by the bidder, the District will make its final decision as to whether the bidder’s request for substitution for any Specified Items will be granted. The decision as to whether a proposed request for substitution is equal to a Specified Item shall be at the sole discretion of the District.
1. Any request for substitution that is granted by the District shall be documented and processed through a Change Order.

2. The District may condition its approval of any substitution upon delivery to the District of an extended warranty or other assurances of adequate performance of the substitution.

3. Any and all risks of delay due to approval by the DSA or any other governmental agency having jurisdiction shall be on the bidder.

4. In the event that the bidder has agreed in the Request Form to provide the Specified Item and the District denies the bidder’s requested substitution for a Specified Item, the bidder shall provide the Specified Item without any additional cost or charge to the District.

L. If the Architect and District accept a proposed substitution, the Contractor agrees to pay for all engineering and design services, including, without limitation, compensation to the Architect and affected engineers for their required time to process such substitution through the Division of the State Architect, if required, and to make all changes and adjustments in materials or the work of all trades directly or indirectly affected by the substituted item or items at no cost to the District.

M. Substitutions will not be considered for acceptance (or, at the District’s sole discretion, District may make Contractor solely responsible for all resulting costs, expenses and other consequences of a substitution) when a substitution:

1. Results in delay meeting established construction milestones and/or Phase completion dates.

2. Is indicated or implied on submittals without formal Substitution Request from Contractor.

3. Is requested directly by a Subcontractor or supplier.

4. Acceptance will require substantial revision to the Contract Documents.

5. Disrupts the Contractor’s Work progress or ability to perform efficiently.

N. Substitute products shall not be ordered without written acceptance of Architect and District.

O. Architect and/or District shall determine acceptability of proposed substitutions and reserve right to reject proposals due to insufficient information.

P. Accepted substitutions will be evidenced by a Change Order. All Contract Document requirements apply to all Work involving substitutions.

Q. Coordinate all substitute products with Contractor’s Construction and Submittal Schedules.

1.6 PRODUCTS WITH NO SUBSTITUTION ALLOWED

A. No substitutions shall be allowed for District standard products. District standard products include:

1. Schlage door locksets and latch sets

2. Siemens Fire Alarm System

3. Access Control: Software House

4. Intrusion Alarm Monitoring: Intrusion Alarm Monitoring: TEL TEC
1.7 PRODUCT SUBSTITUTION REQUESTS: REQUIRED INFORMATION

A. Requests for substitutions of products, materials, or processes in place of a specified item must in writing on the District’s Substitution Request Form at the time of submitting bids to the District.

B. Except as provided in the Contract Documents with respect to “or equal” items, District will consider a Contractor’s substitution request only when the specified product or products become unavailable due to no fault of Contractor.

C. Requests for review of proposed substitute items will not be accepted from anyone other than Contractor.

D. A Request for Substitution shall state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice Contractor’s achievement of Substantial Completion of the Work or any Phase of the Work on time pursuant to the completion dates specified in the Contract Documents, and whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with the District for Work on the Project.)

E. Substitution Product List: Submit a list, in tabular form, showing specified product(s) and requested substitute product(s). Include generic names of products required, and manufacturer’s proprietary name for each product. Provide all product data for each requested substitute product, variations from specified product, and other pertinent data as specified herein.

F. Submit separate submittals (four copies) for each product substitution requested, to include the following:
   1. A statement either explaining why the specified product cannot be provided or why the Contractor is proposing a substitution.
   2. Product identification, including specification section number, and title.
   3. Manufacturer’s literature, including product data and specifications.
   4. Physical samples, as applicable
   5. Color chart, as applicable.
   6. Name and address of similar projects on which product has been used, and dates of installation.
   7. Name, address, and telephone number of supplier, installer, and manufacturer’s representative.
   8. Construction methods: Include detailed description with drawings or other illustrations as required for clarity.
   9. Provide product availability information with projected delivery date.
   10. A completed Substitution Request Form (see Section 01340 “Administrative Forms and Logs”) for each product substitution requested. Submittals with an incomplete Substitution Request Form will be returned to the Contractor without review.
   11. A detailed comparison of the proposed substitution with specified product, listing all variations including all dimensional, weight, service requirements, and functional
12. Indicate available maintenance, repair, and replacement services for substitute products.

13. Contractor shall state whether the substitute will require a change in any of the Contract Documents (or provisions of any other direct contract with District for work on the Project) to adapt the design for the proposed substitute, and whether or not incorporation or use of the substitute in connection with Work is subject to payment of any license fee or royalty.

14. Contractor shall provide an accurate cost comparison of the proposed substitution with the specified product and identify the net change in Contract Price related to use of the proposed substitution.
   a. The cost comparison shall include, but not be limited to, an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute and include costs for redesign and/or claims of other contractors affected by the resulting change.
   b. Architect or District may require Contractor to furnish additional cost data concerning the proposed substitute.

15. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by District and separate contractors that will be necessary to accommodate proposed substitution.

16. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

17. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities have jurisdiction.

18. Submit complete information identifying any changes to the Contractor’s Baseline CPM Schedule required as a result of the proposed substitution.
   a. If specified product or method of construction cannot be provided within Contract Time, include letter from manufacturer, on manufacturer’s letterhead, stating lack of availability or other reason for delays in delivery.
      i) Contractor’s certification that proposed substitution complies with requirements in the Contract Documents.

19. Contractor’s waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

1.8 CONTRACTOR’S REPRESENTATION AND WARRANTY

A. Contractor’s Substitution Request constitutes a representation and warranty that Contractor complies with all of the following requirements:

1. Contractor has investigated proposed product and determined that it meets or exceeds, in all respects, the requirements for the specified product.

2. Contractor shall provide the same warranty for substitution as for specified product.

3. Contractor shall coordinate installation and make all other changes that may be required for Work to be integrated and complete in all respects.

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4. Contractor waives claims for any additional costs which may subsequently become apparent.

5. Contractor shall compensate District for any Construction Document revisions and/or agency approval costs associated with any product substitution. Any such compensation shall be deducted from the Contract Price by the District via Change Order.

6. Contractor shall be responsible for maintaining the Baseline CPM Schedule and for recovering any time lost due to a product substitution.

7. Contractor shall be responsible for any Baseline CPM Schedule delay caused by late ordering of available specified products caused by Substitution Requests that are subsequently rejected by the District.

8. Contractor shall compensate District for all costs, including extra costs for performing Work under Contract Documents, extra cost to other contractors, and any claims brought against District, caused by late Product Substitution Requests.

1.9 ARCHITECT’S ACTION

A. Architect shall respond in writing to Contractor within (10) working days of receipt of a Substitution Request. Architect’s response shall include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect’s response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Architect shall notify Contractor in writing of decision to accept or reject Contractor’s requested substitution.

C. If necessary, Architect may request additional information or documentation for evaluation Substitution Request. Architect shall notify Contractor of acceptance or rejection of proposed substitution within (5) working days of receipt additional information of documentation.

1.10 ADMINISTRATIVE REQUIREMENTS

A. Specified products, materials, or systems for Project may include engineering or on-file standards required by the regulatory agency. Contractor’s substitution of products, materials or systems may require additional engineering, testing, reviews, approvals, assurances, or other information for compliance with regulatory agency requirements, or both. Contractor shall provide all agency approvals or other additional information required and pay additional costs for required District services made necessary by the substitution at no increase in Contract Price or Contract Time, and as a part of substitution proposal.

PART 2 – PRODUCTS
Not Used

PART 3 – EXECUTION
Not Used

END OF SECTION 01625
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions of General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01400 – “Quality Control Requirements”
B. Section 01500 – “Temporary Facilities and Controls”
C. Section 01505 – “Construction Waste Management”
D. Section 01572 – “Storm Water Pollution Prevention Plan”
E. Section 01722 – “Execution Requirements”
F. Section 01770 – “Contract Closeout Procedures”
G. Divisions 2 through 33 Sections for specified Cleaning Requirements for the work in those Sections.

1.3 DISPOSAL OF MATERIALS

A. See Section 01505 (Construction Waste Management) for additional requirements.
B. As part of the scope of Work included within the Contract Price, Contractor shall be fully responsible for disposing of all construction debris, dirt and spoils resulting from the Work.
C. All waste materials, debris, dirt and rubbish shall be disposed of at sites to be chosen by Contractor in accordance with applicable local, state and federal regulations and requirements of the Contract Documents. Also see Sections 01505 and 01412.
D. Contractor is cautioned that both the County of Contra Costa and cities within the County have regulations governing the disposal of rubble, broken pavement, and similar materials.
E. Contractor shall become familiar with the requirements of the agency having jurisdiction over any contemplated disposal site and shall comply with requirements.
F. This is already addressed in Section 01505/1.7 and 1.11. Under no circumstances shall rubbish, debris, waste, dust, dirt or surplus materials be allowed to accumulate in the building or on the Site, and all such shall be removed continually as the Work progresses and by the end of each day’s Work.
   1. Materials: In occupied building areas, only sufficient materials and flammable or toxic substances necessary for the Work being performed that day or shift shall be brought into the building and work areas. In no case shall flammable or toxic substances be stored in the building, and these substances shall be immediately removed from the building when not needed and not later that the end of the day’s Work.
   2. Splattering or spilling of material shall be promptly cleaned up at time of occurrence.
G. Contractor shall provide sweeping whenever silt from Site is carried over to adjacent pedestrian paths, parking lots, and streets within the Campus as well as public thoroughfares surrounding the Campus.

H. Failure to maintain a clean and orderly Site may necessitate action by the District. In the event that the Contractor fails to clean up and maintain the project in a clean and orderly manner, the District may clean the Site and charge the Contractor for such cleaning costs. Any cleaning costs incurred by District will be deducted from the Contract Price by Change Order.

I. All trash, debris, waste, and excess soil resulting from performance of the Work shall be disposed of at sites to be chosen by Contractor in accordance with applicable local, state, and federal regulations. If Contractor elects to dispose of soil on any private property, a permission letter shall be obtained from the property owner and presented to District prior to disposal. Contractor is advised that the property owner is required to obtain a fill permit from the applicable government agency(ies). In addition, placement of fill in wetland areas is subject to permit procedures of the US Army Corps of Engineers. At the completion of Work, a letter from each affected property owner releasing Contractor, Contra Costa County, District, and District consultants from any future liability.

1.4 FINAL CLEANING

A. District’s Representative’s Inspection: Provide District at least twenty-four (24) hours advance notice of readiness for inspection.

B. Any deficient cleaning, as determined by District’s Representative, shall be immediately corrected as directed by District at Contractor’s expense.

C. Contractor shall execute final cleaning prior to final inspection, using only properly skilled workers.

D. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from exposed interior and exterior finished surfaces.

E. Repair, patch, and touch up marred surfaces to match adjacent finishes.

F. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances, clean and/or polish all transparent and glossy surfaces,

G. Vacuum carpeted and soft surfaces.

H. Remove waste and surplus materials, rubbish, and construction facilities from Site.

I. Wash and shine mirrors.

J. Ventilating systems:
   1. Clean permanent filters and replace disposable filters of units operated during construction; in addition, clean ducts, blowers, and coils when units have been operated without filters during construction.
   2. Clean ducts, blower, and coils of units operated during construction.

K. Clean surfaces of equipment; remove excess lubrication.

L. Clean plumbing fixtures to a sanitary condition

M. Vacuum and wipe inside of electrical panels and cabinetwork.

N. Clean light fixtures and lamps.

O. Broom clean interior spaces.
P. Clean, damp mop, wax and polish resilient and hard-surfaced floors as specified.

Q. Remove waste, debris and surplus materials from site. Clean grounds; remove stains, spill, and foreign substances from paved areas and sweep clean. Rake clean other exterior surfaces.

R. Use cleaning materials which will not create hazards to health or property or cause damage to the Work. Use cleaning materials and methods recommended by the manufacturers of the products to be cleaned.

S. Contractor shall not use nor permitted to use any kind of material/cleaning chemical that are not permitted for use in the State of California, or not permitted by the Health Department.

T. Schedule operations to prevent dust and other contaminants resulting from cleaning operations from adhering to wet or newly finished surfaces.

U. Clean roofs, gutters, downspouts and drainage systems.

V. Interior surfaces and areas where Work is performed shall be left in vacuum clean condition with all dust, dirt, stains, hand marks, paint spots, plaster droppings, and other blemishes and defects completely removed. To the extent of Contractor’s operations, use or materials, the following requirements apply to all areas where Work is performed:

1. Walls: Bare and painted surfaces shall be cleaned and free of dust, lint, streaks, or stains.

2. Hardware and metal surfaces shall be cleaned and polished using non-corrosive and non-abrasive materials.

3. Glass: New glass and soiled existing glass shall be washed and polished both sides and left free of dirt and spots. Labels shall be removed.

4. Ceilings shall be clean and free of stains, hand marks, and defacing.

5. Fixtures and Equipment: New mechanical and electrical fixtures and like items shall be cleaned and polished. Lighting fixtures shall be free of dust, dirt, stains, or waste material. Equipment and machinery shall be cleaned, serviced, and ready for use. Existing items shall be cleaned as required including ventilating supply and return equipment in walls and ceilings.

6. Surfaces not mentioned shall be cleaned according to the intent of this Section and as required for District’s Representative’s approval.

PART 2 – PRODUCTS
Not Used

PART 3 – EXECUTION
Not Used

END OF SECTION 01710
SECTION 01722
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01050 – “Field Engineering”
C. Section 01055 – “Conformance Surveying”
D. Section 01311 – “Project Management and Coordination”
E. Section 01710 – “Cleaning Requirements”
F. Section 01770 – “Contract Closeout Procedures”
G. Divisions 2 through 33 Sections for Execution Requirements for the work in those Sections.

1.3 SUMMARY
A. This Section includes Administrative and General procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout
   2. General installation of products
   3. Coordination of District-installed products
   4. Starting and adjusting
   5. Protection of installed construction
   6. Correction of the Work

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION

3.1 EXAMINATION
A. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record all observations in writing.
   1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
a. Description of the Work
b. List of detrimental conditions, including substrates
c. List of unacceptable installation tolerances
d. Recommended corrections

2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

B. Existing Site and/or Building Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning Work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of all utility services for each Phase of the Work and the entire Project.

C. Existing Utilities: The existence and location of underground and other utilities and construction indicated in the Contract Documents as existing are not guaranteed. Prior to beginning the Work, investigate and verify the existence and location of all underground utilities and/or other improvements affecting the Work.

1. Before construction, verify the location and invert all elevations at points of connection of sanitary sewer, storm sewer, and water-service piping; and all underground electrical services.

2. Furnish location data for work related to Project that must be performed by public utilities serving Site.

3.2 PREPARATION

A. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a written request for information (RFI) to the District and a copy to the Architect.

B. Existing Utility Information: Furnish information to the District and a copy to the Architect that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Contractor shall coordinate with authorities having jurisdiction.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, Contractor shall investigate and verify all dimensions of other construction by field measurements before fabrication. Contractor shall coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Contract Documents. Contractor shall be responsible for all coordination and measurements including means and methods of Construction.
3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, Contractor shall verify layout information and Field condition in relation to the Contract documents. Notify District and copy the Architect immediately of any discrepancies.

3.4 INSTALLATION

A. Contractor shall locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in furnished areas, unless otherwise indicated.
   4. Maintain minimum headroom clearance of eight feet in spaces without a suspended ceiling.

B. Contractor shall comply with manufacturer’s written instructions and recommendations for installing products in applications indicated.

C. Contractor shall install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for performance until accepted by District.

D. Contractor shall conduct construction operations, so no part of the Work is subjected to damage or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels. Contractor shall comply with noise requirements in Section 01416, Special Procedures

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

H. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

I. Allow for building movement, including thermal expansion and contraction.

J. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the Site in time for installation.

K. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

L. Hazardous Materials: Use only products, cleaners, and installation materials that are not classified as or considered hazardous.
3.5 DISTRICT-INSTALLED PRODUCTS

A. Site Access: Provide access to Site for District’s construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by District construction forces.

1. Baseline CPM Schedule: Inform District of Contractor’s preferred schedule for District’s portion of the Work. Adjust Baseline CPM Schedule based on a mutually agreeable timetable. Provide timely notice (i.e., at least 14 calendar days) to the District if changes to schedule are required due to differences in actual construction progress.

2. Pre-installation Conferences: Include District’s construction forces at pre-installation conferences covering portions of the Work that are to receive District’s work. Attend pre-installation conferences conducted by District’s construction forces if portions of the Work depend on District’s construction forces.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer’s written instructions for temperature and relative humidity.

3.7 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements Section 01730, Cutting and Patching.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition. See also Section 01500, Temporary Facilities and Controls.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and/or broken glass or reflective surfaces.

END OF SECTION 01722
SECTION 01730
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this section without limitation.

B. Individual Product Specification Sections:
1. Cutting and patching incidental to work of the section.
2. Advance notification to other sections of openings required in work of those sections.
3. Limitations on cutting structural members.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01311 – “Project Management and Coordination”
B. Section 01710 – “Cleaning Requirements”
C. Section 01722 – “Execution Requirements”
D. Divisions 2 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS
A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
B. Patching: Fitting and repair work required to restore surfaces to new or original conditions after installation of other Work.

1.4 RESPONSIBILITIES
A. Contractor shall be responsible for all cutting, fitting, and patching, including associated excavation and backfill, required to complete the Work. This includes, but is not limited to:
1. Making parts fit together properly
2. Removal and replacement of defective Work
3. Removal and replacement of Work not conforming to requirements of Contract Documents
4. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit
5. Attaching new materials to existing improvements
6. Painting (or other finishes) to match adjacent or existing conditions

B. Contractor shall not cut or alter any part of the Work in such a way that endangers or compromises the integrity of the Work, the work of others, or the Project.
1.5 QUALITY ASSURANCE

A. Requirements for Cutting and Patching relating to structural elements: Do not cut and/or patch structural elements in a manner that would alter their structural design characteristics.

1. Obtain written approval of the cutting and patching proposal from the Structural Engineer of Record prior to cutting and/or patching any structural elements. Structural elements include, but are not limited to:
   a. Foundation construction
   b. Structural Concrete
   c. Structural Steel
   d. Wood Framing
   e. Bearing and retaining walls
   f. Stair systems
   g. Roofing and framing systems
   h. Glue lam beam
   i. Shear wall systems

2. Where cutting and patching Work involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure. Contractor shall be responsible for any costs associated with required Structural Engineer and/or DSA reviews and approvals.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

C. Visual Requirements: Do not cut and patch exposed Work in a manner that would, in the Architect or District’s opinion, reduce the building’s aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner as directed by District.

D. Contractor shall ensure that all cutting, fitting, and patching shall achieve the security, strength, weather protection, and appearance for aesthetic match, efficiency, operational life, maintainability, safety of operational elements, and the continuity of existing fire ratings as required by the Contract Documents.

E. Contractor shall ensure that cutting, fitting, and patching shall successfully duplicate undisturbed adjacent profiles, materials, textures, finishes, colors, and that materials shall match existing construction. Where there is dispute as to whether duplication is successful or has been achieved to a reasonable degree, the District’s decision shall be final.

F. Operational Elements: Do not cut and patch operating elements and/or related components in a manner that results in reducing their capacity to perform as intended, results in increased maintenance requirements, that decreases operational life, or that affects system or component safety. Operating elements include, but are not limited to the following:
1. Fire-suppression systems.
2. HVAC systems.
3. Control systems.
4. Mechanical systems piping and ducts.
5. Air smoke barriers
6. Telephone and communication systems.
7. Electrical wiring systems.
8. Primary operational systems and equipment.

G. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or those results in increased maintenance or decreased operational life or safety. Miscellaneous elements include, but are not limited to the following items:
1. Exterior curtain wall construction
2. Equipment supports
3. Noise-and vibration-control elements and systems
4. Water, moisture, or vapor barriers
5. Membranes and flashings
6. Vessels, and equipment

1.6 PAYMENT FOR COSTS

A. Cost caused by ill-timed or defective cutting and patching Work or Work not conforming to Contract Documents, including costs for additional services of the District and its consultants will be borne by the Contractor and deducted from the Contract Price via Change Order by the District.

B. Cost of Work cutting, and patching Work performed upon approval from the District, other than defective or nonconforming Work, will be paid by District via written Change Order.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, cut, patch, and repair materials and surfaces damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties of any affected Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Contractor shall provide for replacement and restoration of any Work affected by cutting and patching operations. Contractor shall comply with the Contract Documents and with the Industry Standard(s), for the type of Work involved. If not specified, Contractor shall first recommend a product of a manufacturer or appropriate trade association for approval by the District.
B. Materials to be cut and patched include those damaged by Contractor in the performance of the Work.

C. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. If identical materials are unavailable or cannot be used, use materials whose installed performance will equal or exceed that of existing materials and that are visually compatible in the sole opinion of the District.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor shall inspect existing conditions of the Site and the Work, including elements subject to movement or damage during cutting and patching, excavating and backfilling. After uncovering Work, Contractor shall inspect conditions affecting the installation of new products.

B. Contractor shall report unsatisfactory or questionable conditions in writing to District as indicated in the Contract Documents and shall proceed with Work as directed by District.

3.2 PREPARATION

A. Contractor shall provide adequate shoring, bracing and supports as required to maintain structural integrity for all portions of the Project during cutting and patching operations.

B. Contractor shall provide devices and means and methods to protect other portions of Project from damage during cutting and patching operations.

C. Contractor shall provide all necessary protection from weather and extremes of temperature and humidity for the Project, including without limitation, any work that may be exposed by cutting and patching Work. Contractor shall keep excavations free from water.

D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

E. Do not cut existing pipe, conduit, or ductwork serving existing buildings and/or other improvements that are scheduled to be removed or relocated until provisions have been made to bypass them. Maintain all active existing services at all times.

3.3 PERFORMANCE

A. With respect to performance, Contractor shall:

1. Execute cutting and patching Work to provide finished installation complying with specified tolerances and matching adjacent finishes.

2. Execute cutting and patching using means and methods that will prevent damage to other Work, and that will result in proper surfaces to receive installation of repairs and/or new Work.

3. Execute cutting, demolition, patching, excavating, and backfilling by methods that will prevent damage to other Work and damage from settlement or other movement.

4. Contractor shall employ original installer or fabricator to perform cutting and patching for:
   a. Weather-exposed surfaces and moisture-resistant elements such as roofing, sheet metal, sealants, waterproofing, and other similar Work.
b. Exposed finished surfaces

5. Contractor shall fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Contractor shall conform to Contract Document requirements for penetrations. If a discrepancy exists between applicable Code requirements and the Contract Documents, the more stringent requirement shall apply.

6. Completed cutting and patching Work shall not affect the integrity of fire walls, ceilings, floors, smoke barriers, shafts, and similar components.

7. Contractor shall restore Work which has been cut or patched. Contractor shall install new products to provide completed Work in accordance with requirements of the Contract Documents and as required to match adjacent areas and surfaces.

8. Contractor shall refinish all continuous surfaces to nearest intersection as necessary to match the new finish to any existing finish.

9. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage adjacent Work to remain. If possible, review proposed procedures with original Installer and comply with his written recommendations.
   a. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   b. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

10. Concrete and Masonry: cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

11. Excavating and Backfilling: Comply with requirements in applicable specification sections where required by cutting and patching operations.

12. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

13. Proceed with patching after construction operations requiring cutting are complete.

14. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

15. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

16. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   a. Clean all materials affected by cutting and patching operations before applying finishes.
   b. Restore any damaged pipe covering to original condition.
   c. Floors and Walls: Where walls or partitions that are removed extend from one finished area into another, patch and repair floor and wall surfaces in the both spaces. As
required to provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials as necessary to achieve uniform color and appearance.

d. Where patching occurs on a painted surface, apply specified primer and intermediate coats over the patch. Apply final coat over entire unbroken surface containing the patch. Provide additional coats as required until patched area blends completely with adjacent surfaces.

17. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide a level, planar surface of uniform appearance.

18. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition and results in a uniform visual appearance.

B. Cleaning: Clean areas, spaces, materials, and/or equipment where cutting and patching Work is performed. Completely remove dirt, dust, cuttings, paint, mortar, oils, putty, adhesive, and any other similar materials.

C. Alterations to Existing Work:

1. Existing work shall be cut, drilled, altered, removed, or temporarily removed and replaced as necessary for performance of work under the Contract. Work that is replaced shall match similar existing work. Structural members shall not be cut or altered, except where noted on drawings, without authorization of the Structural Engineer. Work remaining in place, which is damaged or defaced during this contract, shall be restored to the condition existing at time of award of contract.

2. Discolored or unfinished surface exposed by removal of existing work and indicated to be the final exposed surfaces shall be refinished or the material shall be replaced as necessary to make contiguous work uniform and harmonious. Work out of alignment, where exposed by removal of existing work, shall be called to the District’s attention with a copy to the Architect’s.

END OF SECTION 01730
SECTION 01740

WARRANTIES/GUARANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED DOCUMENTS SPECIFIED IN OTHER SECTIONS

A. Section 01010 – “Summary of Work”
B. Section 01770 – “Contract Closeout Procedures”
C. Section 01780 – “Project Record Documents”
D. Section 01820 – “Demonstration and Training Procedures”
E. Divisions 2 through 33 Sections for Warranties/Guaranties requirements for the Work in those Sections.

1.3 SUMMARY OF WORK

A. Contractor hereby warrants and guaranties to District all Work performed on this Project, including all material and equipment incorporated therein, as set forth below:

B. Pursuant to the requirements of this Section and other sections of the Contract Documents, Contractor agrees to unconditionally warranty and guaranty the quality and adequacy of all of Work provided under this Contract including, without limitation, all labor, materials and equipment provided by the Contractor and Subcontractors of all tiers in connection with the Work.

C. Contractor’s Warranty and/or Guaranty shall become effective on the first day following District’s issuance of a written Notice of Substantial Completion or on such other date as may be specified elsewhere in the Contract Documents, and once effective, the Warranties and/or Guaranties shall remain operative and shall bind Contractor as further described herein for a period of one (1) year, and/or more as specified in the Contract Documents.

D. All Contractor Warranties and/or Guaranties must be reviewed and accepted by District.

E. Neither final payment nor use or occupancy of the Work performed by the Contractor shall constitute an acceptance of Work not done in accordance with Contract Documents, nor relieve Contractor of liability in respect to any express warranties and/or guaranties or responsibilities for faulty materials or workmanship.

F. Contractor shall remedy any defects in the Work and repair any associated damage resulting therefrom, and pay all costs for any such Work which shall become evident within any Project Warranty and/or Guaranty period. If any Work is found to be defective within any Project...
Warranty and/or Guaranty period, Contractor shall, without cost to District, promptly correct such defective Work.

G. Contractor shall remove any defective Work rejected by District and replace it with Work that complies in all respects to the requirements of the Contract Documents. Remove and replace any damage to other Work or the Work of others resulting therefrom.

H. If Contractor fails to promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, District may have the defective Work corrected or the rejected Work removed and replaced. Contractor shall pay for all costs, losses and damages caused by or resulting from such removal and replacement within the Warranty and/or Guaranty period.

I. Where Contractor fails to correct defective Work, or defects are discovered outside the Warranty and/or Guaranty period, District shall have all rights and remedies granted by law.

J. Inspection of the Work shall not relieve Contract of any of its obligations under the Contract Documents. Even though equipment, materials, or Work required to be provided under the Contract Documents have been inspected, accepted, and paid for, Contractor shall, at its own expense, replace or repair any such equipment, material, or Work found to be defective or otherwise not to comply with the requirements of the Contract Documents up to the end of the guaranty period.

K. These Warranties and/or Guaranties are in addition to any other warranty or guaranty requirements contained in the Contract Documents, and not in lieu of any other liability imposed on Contractor under the Contract Documents and governing laws with respect to Contractor’s duties, obligations, and performance under the Contract Documents.

1.4 FORMAT

A. Contractor shall separate each warranty and/or guaranty with index tab sheets keyed to a Table of Contents listing, providing full information and using separate typed sheets as necessary. Contractor shall list each applicable and/or responsible subcontractor, supplier, and/or manufacturer, with name, address, telephone number, fax number, and e-mail of each responsible principal.

1. Bind warranties and guaranties and bonds in heavy-duty, 3-ring vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 ½-by 11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty and/or guaranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number, fax number, and e-mail of installer.

3. Identify each binder on the front and spine with the typed or printed title “WARRANTIES”.

   a. Project name and number
   b. Architect’s name
   c. Contractor’s name

B. Contractor shall provide two (2) sets of binders for all Warranties/Guaranties and shall include:

   1. Contractor, subcontractor, and equipment supplier shall provide Warranties and Guaranties on their original company letterhead with original signature.
2. Contractor shall provide original Warranties and Guaranties. Photo copies, fax and e-mail copies are not acceptable.

C. Contractor shall organize warranty and guaranty documents into an orderly sequence based on the table of contents of the Project Manual.

1.5 PREPARATION

A. Contractor shall obtain warranties and guaranties, executed in duplicate by each applicable and/or responsible subcontractor(s), supplier(s), and manufacturer(s), within fifteen (15) days after Substantial Completion. Except for items put into use with District’s permission, Contractor shall leave date of beginning of time of warranty or guaranty blank until the date of completion is determined by District.

B. Contractor shall verify that documents are in proper original form, contain full information, and are notarized, when required.

C. Contractor shall co-sign and co-execute all Warranties and Guaranties.

D. Contractor, subcontractor, and equipment supplier must provide warranties/guaranties on their original company letterhead with original authorized principal charge signature. (Fax copy and e-mail will not be acceptable.)

E. Contractor shall provide additional copies of each warranty and/or guaranty to include in operation and maintenance manual. Photocopies are acceptable for this purpose.

F. For items of work delayed beyond date of Substantial Completion, Contractor shall provide updated submittal within ten (10) days after acceptance, listing the date of acceptance by District as start of the warranty and/or guaranty period.

G. Contractor must complete all warranty and guaranty submittals as required by the Contract Documents prior to District approval of Contractor’s final application for Payment.

1.6 WARRANTY AND GUARANTY MANAGEMENT

A. Warranty and Guaranty Management Plan

1. Develop a warranty and guaranty management plan which contains information relevant to Specification Section 01740, Warranties/Guaranties. At least 30 days before the planned Substantial Completion date, conduct a pre-warranty conference and, submit the warranty and guaranty management plan for District approval. Include within the warranty and guaranty management plan all required actions and documents to assure that the District receives all warranties and guaranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term “status” as indicated below must include due date and whether item has been submitted or was accomplished. Warranty and guaranty information made available during the construction phase must be submitted to the District for approval prior to each monthly pay estimate. Assemble approved information in a binder and submit to the District upon acceptance of the Work. The construction warranty and guaranty period will begin on the date of Substantial Completion and continue for the full product warranty and guaranty period. A joint 9-month warranty and guaranty inspection will be conducted, measured from Substantial Completion.
Completion, by the Contractor, District, and the Campus Representative. Include within the warranty and guaranty management plan, but not limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty and guaranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Listing and status of delivery of all Certificates of Warranty and Guaranty for extended warranty and guaranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

c. A list for each warranted equipment, item, feature of construction or system indicating:
   i) Name of item.
   ii) Model and serial numbers.
   iii) Location where installed.
   iv) Name and phone numbers of manufacturers or suppliers.
   v) Names, addresses and telephone numbers of sources of spare parts.
   vi) Warranties and Guaranties and terms of warranty and/or guaranty. Include one-year overall warranty of construction. Items which have extended warranties or guaranties must be indicated with separate warranty and guaranty expiration dates.
   vii) Cross-reference to warranty and guaranty certificates as applicable.
   viii) Starting point and duration of warranty and guaranty period.
   ix) Summary of maintenance procedures required to continue the warranty and guaranty in force.
   x) Cross-reference to specific pertinent Operation and Maintenance manuals.
   xi) Organization, names and phone numbers of persons to call for warranty and guaranty service.
   xii) Typical response time and repair time expected for various warranted equipment.

d. The Contractor’s plans for attendance at the 9-month post-construction warranty and guaranty inspections conducted by the District.

e. Procedure and status of tagging of all equipment covered by extended warranties and guaranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and guaranty and/or safety reasons.

B. Pre-Warranty Conference

1. At least thirty calendar days prior to Contract Substantial Completion, and at a time designated by the District, meet with the District Representatives to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty and guaranty defects, priorities with respect to the type of defect, reasonable time required for Contractor
response, and other details deemed necessary by the District for the execution of the construction warranty and guaranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty and guaranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, be continuously available, and be responsive to District inquiry on warranty and guaranty work action and status.

2. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

C. Contractor's Response to Construction Warranty and Guaranty Service Requirements

1. Following oral or written notification by the District, respond to construction warranty and guaranty service requirements in accordance with the "Construction Warranty And Guaranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty and guaranty item that has been repaired during the warranty and/or guaranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty and/or guaranty within the timeframes specified, the District will perform the work and back-charge Contractor.

   a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

   b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

   c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

   d. The "Construction Warranty and Guaranty Service Priority List" is as follows:

      Code 1-Air Conditioning Systems
      (1) Recreational support.
      (2) Air conditioning leak in part of building, if causing damage.
      (3) Air conditioning system not cooling properly.

      Code 1-Doors
      (1) Overhead doors not operational, causing a security, fire, or safety problem.
      (2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

      Code 3-Doors
      (1) Overhead doors not operational.
      (2) Interior/exterior personnel doors or hardware not functioning properly.

      Code 1-Electrical
      (1) Power failure (entire area or any building operational after 1600 hours)
      (2) Security lights
      (3) Smoke detectors
Code 2-Electrical
(1) Power failure (no power to a room or part of building).
(2) Receptacle and lights (in a room or part of building).

Code 3-Electrical
Street lights.

Code 1-Gas
(1) Leaks and breaks.

Code 1-Heat
(1) Area power failure affecting heat.
(2) Heater in unit not working.

Code 2-Kitchen Equipment
(1) Dishwasher not operating properly.
(2) All other equipment hampering preparation of a meal.

Code 1-Plumbing
(1) Hot water heater failure.
(2) Leaking water supply pipes.

Code 2-Plumbing
(1) Flush valves not operating properly.
(2) Fixture drain, supply line to commode, or any water pipe leaking.
(3) Commode leaking at base.

Code 3-Plumbing
Leaky faucets.

Code 3-Interior
(1) Floors damaged.
(2) Paint chipping or peeling.
(3) Casework.

Code 1-Roof Leaks
Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)
No water to facility.

Code 2-Water (Hot)
No hot water in portion of building listed.

Code 3-All other work not listed above.

D. Warranty and/or Guaranty Tags

1. At the time of installation, tag each warranted or guaranteed item with a durable, oil and water-resistant tag approved by the District. Attach each tag with a copper wire and spray with a silicone waterproof coating. The date of Substantial Completion and the Contractor
Authorized signature must remain blank until the date the District makes a determination of Substantial Completion. Show the following information on the tag:

**WARRANTY/GUARANTY INFORMATION – D-4002 San Ramon Expansion – Increment 1**

a. Type of product/material___________________________________________________.
b. Model number_______________________________________________________________.
c. Serial number_______________________________________________________________.
d. Contract number___________________________________________________________.
e. Warranty/Guaranty period_____ (months) from ___________ to _________________.
f. Inspector’s signature___________________________________________________________.
g. Construction Contractor_______________________________________________________.
   Address_______________________________________________________________.
   Telephone number_______________________________________________________.
h. Warranty or Guaranty contact___________________________________________________.
   Address_______________________________________________________________.
   Telephone number_______________________________________________________.
i. Warranty or Guaranty response time priority code_______________________________.

**WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.**

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used.

END OF SECTION 01740
SECTION 01770
CONTRACT CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1  RELATED DOCUMENTS
A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2  RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
A. Section 01010 – “Summary of Work”
B. Section 01290 – “Payment Procedures”
C. Section 01310 – “Construction Scheduling”
D. Section 01321 – “Photographic Documentation”
E. Section 01330 – “Submittal Procedures”
F. Section 01410 – “Regulatory Requirements”
G. Section 01710 – “Cleaning Requirements”
H. Section 01722 – “Execution Requirements”
I. Section 01740 – “Warranties and Guaranties”
J. Section 01780 – “Project Record Documents”
K. Divisions 2 through 33 Sections for Contract Closeout Procedure requirements for the work in those Sections

1.3  SUMMARY
A. This section specifies administrative and procedural requirements for Contract closeout.

1.4  CONTRACT CLOSEOUT SUBMITTALS
A. Color prints of full size contractor Marked-up Contract Drawings
B. Color prints of full size contractor marked-up Shop Drawings
C. Professionally Drafted As-Built Record Drawings
D. Dated marked-up copies of Conformed Specifications
E. Marked-up Project Data submittals
F. Record Samples
G. Field records for variable and concealed conditions
H. Project Record Documents (See Section 01780)
I. Operating and maintenance manuals and data
J. Warranties and bonds
K. Warranty Management Plan
L. Warranty Tags
M. Spare Parts Data
N. Service and maintenance contracts

1.5 REMOVAL OF TEMPORARY CONSTRUCTION FACILITIES

A. Remove temporary materials, equipment, services, and construction prior to Initial Inspection, unless otherwise noted in other Contract Documents for a removal period subsequent to Initial Inspection but prior to Final Completion

B. Comply with requirements of Section 01500, Temporary Facilities and Controls

1.6 INITIAL PUNCH LIST AND INSPECTION

A. When Contractor considers Work to be Substantially Complete, submit written notice to District’s Representative requesting an Initial Inspection and listing items remaining to be completed or corrected listed by room number and item number (hereinafter “Initial Punch List”). The Contractor and/or its Subcontractors shall proceed promptly to complete and correct items on the list without waiting for District review of the Initial Punch List and inspection of the Work. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

B. In a separate section of the Initial Punch List, include all items which cannot be completed or verified prior to Functional Performance Testing of the entire Work in accordance with Specification Section 01810 General Commissioning and other technical Specifications.

1. The Contractor shall provide the expertise, trades subcontractors, manufacturers’ representatives, or others as required to work collaboratively with the District and its representatives to identify all remaining items of Work, including required testing and verification, which cannot be completed or verified prior to Functional Performance Testing of the entire Work in accordance with Specification Section 01810 General Commissioning.

2. The Initial Punch List items identified to remain for subsequent completion shall not be significant enough to prevent beneficial occupancy and full use of the Work by the District.

C. The Contractor shall not submit a notice requesting an Initial Inspection unless the Work is Substantially Complete.

D. Should District’s Representatives determine that Work is not Substantially Complete, the District will promptly notify Contractor in writing, listing Work that must be completed prior to Substantial Completion. Any inspection list that is submitted to the District that does not result in a District determination of Substantial Completion will not be considered an accepted Initial Punch List. If the Work is determined to not be Substantially Complete, Contractor shall complete all Work as directed prior to requesting an additional Initial Inspection by the District to determine Substantial Completion per this Specification Section.

E. Upon receipt of the Contractor’s Initial Punch List, and not before, the District, Architect, and Project Inspector will make an Initial Inspection to determine whether the Work, is Substantially Complete.
1. All fire and life safety items, manufactured units, equipment and systems that require startup must have been started, run, tested, and operational for periods prescribed by the Contract Documents before a request for Initial Inspection is accepted by the District.

2. All items not completed in accordance with the requirements of the Contract Documents whether identified by the Contractor, District, Architect, Project Inspector, and/or other District Representatives as a result of the Initial Inspection shall be incorporated by the Contractor into a draft Pre-final Punch List which shall be submitted for District review and revision in accordance with Specification Section 01330, Submittal Procedures, prior to a determination by the District of Substantial Completion.

3. If additional Initial Inspections are required to review Initial Punch List items due to incompleteness of the Work by Contractor, Contractor will reimburse District for all costs associated with these inspections if additional service fees by District consultants are required. The costs of such District additional service fees will be deducted from the Contract Price by Change Order.

F. District may enlist Consultants to assist with the above activities.

1.7 SUBSTANTIAL COMPLETION

A. When District determines that the Work is Substantially Complete, District will issue a Certificate of Substantial Completion, accompanied by a Pre-Final Punch List of items to be completed or corrected as verified and/or appended by Architect and District.

B. When the Work is Substantially Complete, the District will file a Notice of Completion.

1. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work, unless otherwise provided in the Notice of Completion.

2. The Notice of Completion shall be submitted to the Contractor for their written acceptance of responsibilities assigned to them in such Notice prior to District filing the Notice of Completion for purposes of initiating the release of Retention for the Work. The District shall withhold from Contractor payment the value of remaining Work, Work to be corrected, incomplete Work, and an amount identified for Pre-final Punch List Work, and as otherwise identified in Public Contract Code.

C. The Contractor shall complete the items listed in the Pre-Final Punch List within ten (10) working days of the Certificate of Substantial Completion, with the exception of the items that must remain incomplete pending final commissioning. The Contractor shall execute the Work such that the District can occupy the Work within seven (7) calendar days of the date of the Certificate of Substantial Completion.

1.8 PRE-FINAL INSPECTION

A. When Contractor considers the items listed in the Pre-Final Punch List to be complete, with the exception of items which cannot be completed or verified prior to Functional Performance Testing of the entire Work in accordance with Specification Section 01810, General Commissioning, and other specification sections, the Contractor shall submit written notice to District’s Representative requesting a Pre-Final Inspection.

B. Upon receipt of the Contractor’s request for Pre-Final Inspection, and not before, the District, Architect, Campus Representatives, and Project Inspector will inspect the Work to determine whether the Work identified on the Pre-Final Punch List is complete, with the exception of items
which cannot be completed or verified prior to Functional Performance Testing of the entire Work in accordance with Specification Section 01810, General Commissioning and other specification sections.

C. Prior to the Pre-Final Inspection, perform final cleaning of the Work, as specified in Section 01710.

1. Inspection Requirements.
   a. Before calling for Pre-Final Inspection, Contractor shall determine that the following Work has been performed:
      i) The Work has been completed.
      ii) All life safety items are completed and in working order.
      iii) All mechanical and electrical Work complete, fixtures in place, connected and ready for tryout and test.
      iv) Electrical circuits scheduled in panels and disconnect switches labeled.
      v) Painting and special finishes are complete.
      vi) Doors complete with hardware, cleaned of protective film, are relieved of sticking or binding and in working order.
      vii) Tops and bottoms of doors sealed.
      viii) Floors waxed and polished as specified.
      ix) Broken glass replaced and glass cleaned.
      x) Grounds cleared of Contractor’s equipment, raked clean of debris, and trash removed from Site.
      xi) Work cleaned, free of stains, scratches, and other foreign matter, and damaged and broken material have been replaced.
      xii) Finishes and decorative work shall have marks, dirt and superfluous labels removed.
      xiii) All other requirements per the Contract Documents.
   b. Furnish a letter to District stating that a responsible representative of District [give name and position] has been instructed in working characteristics of mechanical and electrical systems and equipment. See Specification Section 01820, Demonstration and Training Procedures.

2. All items not completed in accordance with the requirements of the Contract Documents whether identified by the Contractor, District, Architect, Project Inspector, and/or other District Representatives as a result of the Pre-Final Inspection, shall be incorporated by the Contractor into a draft Final Punch List which shall be submitted for District review and revision in accordance with Specification Section 01330, Submittal Procedures, prior to a determination by the District that the Contract is ready for administrative close-out.

3. If additional Pre-final Inspections are required to review the Pre-final Punch List items due to incompleteness of the Work by Contractor, Contractor will reimburse District for all costs associated with these inspections if additional services fees by District consultants are required. The costs of such District additional service fees will be deducted from the Contract Price by Change Order.
1.9 **FINAL INSPECTION**

A. When Contractor considers the items listed in the Final Punch List to be complete the Contractor shall submit written notice to District’s Representative requesting a Final Inspection.

B. Upon receipt of the Contractor’s request for Final Inspection, and not before, the Contractor, District, Architect, and Project Inspector, shall meet to go over the Contract Documents to identify the administrative requirements for contract close-out.

1. The District will prepare a list of requirements remaining for administrative close-out and shall provide the list to the Contractor.
2. The Contractor shall complete all items on the administrative close-out list within thirty (30) days.

C. Subsequent to the meeting to identify administrative close-out requirements, District, Architect, Campus Representatives, and Project Inspector will inspect the Work to determine whether the Work identified on the Final Punch List is complete.

D. If additional Final Inspections are required to review the Final Punch List items due to incompleteness of the Work by Contractor, Contractor will reimburse District for all costs associated with these inspections if additional services fees by District consultants are required. The costs of such District additional service fees will be deducted from the Contract Price by Change Order.

E. When the Architect determines that all final punch list items have been completed, a final Project Inspection Report will be issued. Any open administrative close-out requirements will be identified and a value for withholding from Progress Payment or Final Payment will be assigned.

F. The Project Inspector (IOR), the District Representative, and the Contractor shall, at all times, be together during all inspections. The Contractor shall give 24-hour notice to the District for such inspections.

1.10 **FINAL COMPLETION**

A. Final Completion occurs when all Work meets all requirements of the Contract Documents. When Contractor considers all Work complete and all close-out requirements have been performed, submitted, and accepted, submit written certification to District that:

1. Contractor has inspected Work for compliance with Contract Documents, and all requirements for Final Completion have been met.
2. Except for Contractor maintenance and Deferred or Seasonal Testing, after Final Completion, all Work has been completed in accordance with Contract Documents and deficiencies listed with any Certificate of Substantial Completion have been corrected. Equipment and systems have been tested in the presence of Architect, Project Inspector (IOR), and District Representatives and are operative.

B. Should District determine that the Work is incomplete or defective or that administrative requirements have not been completed:

1. District’s Representative will promptly so notify Contractor, in writing, listing the incomplete or defective items.
2. Contractor shall promptly remedy all incomplete and/or defective Work and notify the District when it is ready for re-inspection. District’s Representatives will then re-inspect the
Work. If deficiencies previously noted are found not to be corrected, Contractor shall pay all District costs for the re-inspection.

3. When District determines that all Work and requirements are complete under the Contract Documents, District will request Contractor to make a request for Final Payment.

1.11 FINAL ADJUSTMENTS OF ACCOUNTS
A. Submit a final statement of accounting to District, showing all adjustments to the Contract Price. See also Section 01290 Payment Procedures, Final Payment, et al.
B. If required, District shall prepare a final Change Order showing an adjustment to the Contract Price that was not included in previous Change Orders.

1.12 FINAL CLEANING
Contractor shall comply with all applicable requirements in Section 01710, Cleaning Requirements.

1.13 PROJECT RECORD DOCUMENTS
Contractor shall comply with all applicable requirements in Section 01780, Project Record Documents.

1.14 PROJECT WARRANTY
A. Requirements for Contractor’s Warranty of completed Work are included in the General Conditions and Section 01740, Warranties and Guaranties
B. Recording of Final Completion, final certificate for payment, or partial or entire occupancy of the Work by District shall not constitute acceptance of Work not done in accordance with Contract Documents, and do not relieve the Contractor of liability in respect to express warranties, latent defects, or responsibility for faulty materials or workmanship.
C. District may make repairs to defective Work as set forth in Contract General Conditions.
D. If, after installation, operation, or use of materials or equipment to be provided under Contract proves to be unsatisfactory to District, District shall have right to operate and use materials or equipment until said materials and equipment can, without damage to District, be taken out of service for correction or replacement. Period of use of defective materials or equipment pending correction or replacement shall in no way decrease guarantee period required for acceptable corrected or replaced items of materials or equipment.
E. Nothing in this Section shall be construed to limit, relieve, or release Contractor’s, subcontractors’, and equipment suppliers’ liability to District for damages sustained as result of latent defects in equipment caused by negligence of suppliers’ agents, employees, or subcontractors. Stated in another manner, warranty contained in the Contract Documents shall not amount to, nor shall it be deemed to be, waiver by District of any rights or remedies (or time limits in which to enforce such rights or remedies) it may have for defective workmanship or defective materials under laws of this state pertaining to acts of negligence.

1.15 WARRANTIES
A. Execute Contractor’s submittals and assemble warranty documents as described in Section 01330 Submittal Procedures and Section 01740 Warranties and Guaranties.
1.16 RETURN OF DISTRICT KEYS, PARKING PERMITS AND IDENTIFICATION

Contract Documents will not be closed out and final payment will not be made until all personnel identification media, vehicle permits, and keys issued to Contractor during prosecution of Work are returned to the District Representative.

1.17 RELEASE OF CLAIMS

A. Contract Documents will not be closed out and final payment will not be made until Agreement and Release of Any and All Claims is completed and executed by Contractor and District.

1.18 FIRE INSPECTION COORDINATION

A. Coordinate required fire inspection(s) with governing agencies having jurisdiction and provide sufficient notice to District to permit convenient scheduling (if applicable.)

1.19 BUILDING INSPECTION COORDINATION

A. Coordinate with District, Architect, and Project Inspector final inspection for the purpose of obtaining any occupancy certificate (if applicable.)

1.20 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store Project Record Documents and samples in the Contractor’s field office apart from Contract Documents used for construction.

B. Do not permit Project Record Documents to be used for construction purposes.

C. Maintain Project Record Documents in good order, and in a clean, dry, legible condition.

D. Make documents and samples available for weekly inspections by District, Architect, and Project Inspector.

1.21 RECORD CONSTRUCTION SCHEDULE

A. Using the latest progress schedule required by Section 01330, submittal Procedures as a reference, submit a Record Baseline CPM Schedule showing the actual dates and duration of all construction activities.

B. Sign and date the completed Record Baseline CPM Schedule and deliver to the District prior to Final Completion.

1.22 PROJECT RECORD DRAWINGS

A. Comply with requirements of Section 01780, Project Record Documents.

1.23 PROJECT RECORD SPECIFICATIONS

A. Comply with requirements of Section 01780 Project Record Documents.

1.24 PRODUCT DATA

A. Comply with requirements of Section 01780, Project Record Documents.

1.25 OPERATION TESTS

A. Conduct operational tests as required to demonstrate that all systems have been completed and are in compliance with all requirements.
B. Furnish a written record of test results using recording type instruments where applicable and as directed.

1.26 OPERATION AND MAINTENANCE MANUALS
A. Comply with requirements of Section 01780, Project Record Documents.

1.27 MATERIALS, EQUIPMENT AND FINISHES MANUAL
A. Comply with requirements of Section 01780, Project Record Documents.

1.28 SERVICE AND MAINTENANCE CONTRACTS
A. Compile, review, and submit specified service and maintenance contracts as specified for warranties and bonds.

1.29 MISCELLANEOUS PROJECT RECORD SUBMITTALS
A. Refer to other specification sections for miscellaneous record keeping requirements and submittals. Immediately prior to Final Completion, complete miscellaneous records and place them in good order, properly identified and bound or filed, ready for District use and reference. Submit to the Architect for review and approval.

1.30 EXTRA MATERIALS
A. Where specified, provide extra materials in the quantities and manner specified.

B. Delivery and certification of extra materials shall be prerequisite to Substantial Completion.

PART 2 - PRODUCTS
Not Used.

PART 3 - EXECUTION
Not Used.

END OF SECTION 01770
SECTION 01780
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
   A. Section 01010 – “Summary of Work”
   B. Section 01250 – “Contract Modification Procedures”
   C. Section 01310 – “Construction Scheduling”
   D. Section 01311 – “Project Management and Coordination”
   E. Section 01330 – “Submittal Procedures”
   F. Section 01740 – “Warranties and Guaranties”
   G. Section 01770 – “Contract Closeout Procedures”
   H. Section 01785 – “Operation and Maintenance Data”
   I. Divisions 2 through 33 Sections for Project Record Documents requirements for the work in those Sections.

1.3 SUMMARY
   A. This section includes administrative and procedural requirements for Project Record Documents, including but not limited to the following:
      1. Record Drawings
      2. Record Specifications
      3. Record Product Data
      4. Record MEP & Structural coordination documents
   B. Project Record Documents requirements include, but are not limited to, the following:
      1. Marked-up copies of Drawings
      2. Marked-up copies of Shop Drawings
      3. Newly prepared Drawings
      4. Marked-up Product Data submittals
      5. Field records, such as photographs, for variable and concealed conditions
      6. Record information for Work that is only schematically shown
      7. Maintenance forms for equipment
   C. Other Project closeout requirements are included in Section 01770, Contract Closeout Procedures.
   D. Contractor shall maintain Documents and Samples as follows:
1. Contractor shall provide and store all required Project Record Documents and Samples in the Contractor field office apart from Contract Documents used for Construction. These materials shall be available at any time upon request by the District, Architect and Project Inspector.

2. Project Record Documents shall not be used for construction purposes.

3. Maintain Project Record Documents in good order, and in a clean, dry, legible condition.

E. Contractor shall dedicate one complete full-size set of the Contract Drawings and one complete Project Manual for use in recording as-built conditions.

F. The Contractor shall update the Record Drawings and Annotated Specifications as often as necessary to keep them current, but no less often than weekly.

G. The Record Drawings and Annotated Specifications shall be kept at the Site and available for review and inspection by the District and the Architect.

1.4 PROJECT RECORD DRAWINGS

A. Mark-up Procedure: During the construction period, maintain a complete, current set of full size blackline prints of Contract Drawings and Shop Drawings for Project Record Documents purposes. Label each document (on first sheet or format page) “AS-BUILT RECORD” in 2-inch high printed letters. Keep all record documents current.

B. On completion of the Work and prior to Application for Final Payment, the Contractor will provide one complete set of AS-BUILT RECORD Drawings in AutoCAD (.dwg) file format and one complete set in Adobe PDF file format.

C. A reference by number to a Change Order, CCD, RFI, RFQ, RFP, Field Order or other such document is not acceptable as sufficient record information on any record document. Do not conceal any Work until required record information has been recorded.

1. Contractor shall mark AS-BUILT Record Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to:

   a. Dimensional changes to the Contract Drawings (horizontal and/or vertical)
   b. Revisions or any modification to details shown on the Contract Drawings
   c. Depths of various elements of foundations in relation to main floor level or survey datum.
   d. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
   e. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
   f. Locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stub outs, invert elevations and similar items
   g. Final, actual numbering of each electrical circuit
   h. Revisions to routing of piping and conduits
   i. Revisions to electrical circuitry, including legends at electrical panels
   j. Actual equipment locations
k. Duct size and routing
l. Changes made by Change Order, CCD, ASI, or any other directive
m. Details not on original Contract Drawings

2. Contractor shall mark completely and accurately AS-BUILT Record Drawing prints of Contract Drawings or Shop Drawings, whichever is the most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.

3. Contractor shall mark AS-BUILT Record Drawing sets with red, erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.

4. Contractor shall mark important additional information that was either shown schematically or omitted from original Drawings.

5. Contractor shall note Contractor Change Directive numbers; Bid Alternate numbers, if any, Change Order numbers, and similar identification.

6. Contractor shall be responsible for Mark-up: Where feasible, the individual or entity who obtained Project Record Drawing data, whether the individual or entity is the installer, Subcontractor or similar entity, is required to prepare the mark-up on AS-BUILT Record Drawings.
   a. Accurately record information in an understandable and legible drawing technique.
   b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.
   c. The District, Architect, and Project Inspector will review all record documents each month prior to approval of Contractor’s Application for Payment.

D. Contractor shall prepare Record Drawings: Immediately prior to inspection for Certification of Substantial Completion of the Work, review completed marked-up AS-BUILT Record Drawings with District, Project Inspector, and Architect to ensure accuracy of information. Once accuracy of information is confirmed, prepare and submit a full electronic set, professionally drafted in AutoCAD format, of as-built Contract Drawings and Shop Drawings.
   1. Incorporate changes and additional information previously marked on print sets. Delete, redraw, and/or add details and notations where applicable. Identify and date each Drawing; include the printed designation “AS-BUILT RECORD DRAWING” and the date prepared in a prominent location on each Drawing.
   2. Distribution: Organize and bind original marked-up set of prints that were maintained during the construction period into manageable sets. Bind the set with durable paper cover sheets, with appropriate identification, including titles, dates and other information on cover sheets and submit to District.

E. In addition to requirements of this Section, comply with supplemental requirements of other specification sections.
   1. Section 01330, Submittal Procedures, requires the preparation of large scale, detailed layout drawings of the Work in Divisions 2 through 33. These layout drawings are not Shop Drawings as defined by Section 01330, but together with Shop Drawings or layout drawings of all other affected Sections are used to check, coordinate and integrate the work of the various Sections.
   2. Contractor shall include required layout drawings as part of the Project Record Documents.
1.5 PROJECT RECORD SPECIFICATION

A. Contractor shall, during the construction period, maintain one copy of the Project Specifications, including all addenda and all other modifications issued for Project Record Documents purposes.

B. Contractor shall mark the Project Record specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications and/or modifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, Change Order and Construction Change Directive Work, and information on concealed installation that would be difficult to identify, measure, and record later.

1. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the Record copy with the proprietary name and model number of the product furnished.

2. Where a specification allows Contractor to elect one of several brands, makes, or types of material or equipment, the annotations shall show which of the allowable items the Contractor has furnished.

3. Record the name of the manufacturer, catalog number, supplier and installer and other information necessary to provide an accurate record of selections made, and coordinate documentation with Project Record Data submittals and maintenance manuals.

4. Note any related Project Record Product Data that was submitted in maintenance manuals instead of Product Data submittals.

5. Upon completion of mark-up, submit Project Record Specifications to District for District’s records.

1.6 ADDITIONAL REQUIREMENTS FOR FINAL PROJECT AS-BUILT RECORD DOCUMENTS

A. Using a distinct Auto CAD layer, clearly indicate at each affected plan, detail, schedule, or other drawing as necessary, a full description of changes made during construction along with the actual location of specified items.

B. “Cloud” all changes made using a distinct AutoCAD layer.

C. Submit duplicate electronic files of all drawings in both Auto CAD and Adobe PDF Format.

1.7 PROJECT RECORD PRODUCT DATA

A. Contractor shall, during the construction period, maintain one copy of each Project Record Product Data submittal for “Project Record Document” purposes.

1. Mark Project Record Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Project Record Product Data submitted. Include any significant changes in the product as delivered and/or installed including any departures from the manufacturer’s instructions and/or recommendations for installation.

2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

3. Note related Change Orders and mark-up of Project Record Drawings, where applicable.

4. Upon completion of mark-up, submit a complete set of Project Record Product Data to District for District’s records.
5. Where Project Record Product Data is required as part of maintenance manuals, submit marked-up Project Record Product Data as an insert in the manual, instead of submittal as Project Record Product Data.

6. Contractor is responsible for mark-up and submittal of Project Record Product Data for its own Work.

B. Material, Equipment and Finish Data:

1. General: Provide one (1) preliminary review copy and two (2) final copies each of a "Materials, Equipment and Finishes Manual" listing all finish materials, equipment (not provided under Divisions 15 and 16), and finishes installed in the Work.

2. Submit the preliminary manuals to the Architect a minimum of two (2) weeks prior to Substantial Completion. The preliminary copies must comply with all of the requirements, except the hardboard covers.

3. Obtain approval of preliminary copies prior to producing final copies.

4. Deliver final manuals to the Architect prior to final acceptance and final payment. Architect will deliver manuals to the District.

5. Format of Manual: Provide bound manuals with printed covers and spines. Title "Materials, Equipment and Finishes Manual". Organize data sequentially by Specification Section number on type written 8-1/2 by 11-inch pages. Provide each copy with a typewritten index and tabbed dividers between each separate Section. Mark each tab to indicate contents.

6. Contents of Manual: Manuals shall contain all information needed to identify, maintain, and replace/duplicate any finish materials, equipment, and finishes installed in the Work for this Project. Where materials and product information has been described and likewise indicated in the "Operation and Maintenance Manuals", cross referencing to where they can be found may be done in lieu of duplication of the information. The information provided shall include, but not be limited to, the following:
   a. Manufacturer's names and model numbers or product name; supplier's and subcontractor's name, address and phone and fax numbers; and all other pertinent information that might be required for replacement ordering or duplication at a later date.
   b. For custom fabricated products which do not have model numbers or names, reference Project shop drawing submittal number and indicate "Fabricated per shop drawing submittal Number ____.
   c. Proportions of mixes.
   d. Color formula list for each paint color used.
   e. For power operated equipment, include complete and legible wiring diagrams together with cuts of repair parts and part numbers listed and instructions relative to care, adjustment and operation of the equipment.
   f. For moisture protection and weather exposed products, include complete manufacturer's data with instructions on inspection, maintenance and repair.
   g. Where applicable, provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information regarding cleaning agents and methods that could prove detrimental to the product.
C. Contractor shall arrange Project Record Product Data by Specification Section number, and provide names, addresses, fax numbers, emails addresses, and telephone number of Subcontractors and suppliers. Information to be provided includes:

1. Trade Names
2. Model or type numbers
3. Assembly diagrams
4. Operating instructions
5. Cleaning instructions
6. Maintenance instructions
7. Recommended spare parts
8. Product data

1.8 MISCELLANEOUS PROJECT RECORD SUBMITTALS

A. Refer to other Specification Sections for miscellaneous record keeping requirements and submittals. Immediately prior to Substantial Completion of the Work, complete all miscellaneous records and place in good order, properly identified, and readied for use and reference. Submit to the District for District’s records, in Adobe PDF format. Categories of miscellaneous records include, but are not limited to, the following:

1. Field records on excavations and foundations
2. Field records on underground construction and similar work
3. Survey showing locations and elevations of underground lines
4. Invert elevations of drainage piping
5. Surveys establishing building lines and levels
6. Authorized measurements utilizing unit prices or allowances
7. Records of plant treatment
8. Ambient and substrate condition tests
9. Certifications received in lieu of labels on bulk products
10. Batch mixing and bulk delivery records
11. Testing and qualification of tradespersons
12. Documented qualification of installation firms
13. Load and performance testing
14. Inspections and certifications by governing authorities
15. Leakage and water-penetration tests
16. Fire resistance and flame spread test results
17. Final inspection and correction procedures
18. Final As-Built Construction Schedule
19. Project Record Drawing Mark-ups
20. Other
1.9 INSTALLATION, OPERATION, AND MAINTENANCE MANUALS
   
   A. Submit Installation, Operation, and Maintenance Manuals in accordance with this Section, Section 01330, Submittal Procedures and Section 01785, Operation and Maintenance Data.

1.10 ELECTRONIC MEDIA FORMAT
   
   A. Electronic Media Formats: Electronic media formats shall be Adobe PDF and AutoCAD.

   1. Adobe PDF files shall have chapter markers and/or bookmarks inserted in place of the equivalent hard copy section tabs. Adobe PDF copy shall include all Project Record Drawings, updated Specification Manuals, tables, charts, drawings, codes and all other matters reflected in hard copies. Adobe PDF files shall be delivered on unique CD-ROMs containing Adobe PDF files of each completed project AS-BUILT Record Drawing and the complete Specifications Manual with all changes made during the Project.

   2. In addition to the Adobe PDF file copies, professionally drafted AutoCAD project AS-BUILT Record Drawing DWG files shall be delivered showing both design and as-built information. AutoCAD layouts shall be provided allowing for the reproduction of a complete set of plans as needed.

1.11 DISTRICT’S RECURSE
   
   A. If Contractor is not able to provide Project Record Documents in specified formats, District has the right to complete the Work using other resources. Contractor agrees that any and all costs associated with District completion of this Work shall be deducted from the Contract Price by Change Order.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 RECORDING
   
   A. Post changes and modifications to the Contract Documents as they occur. Do not wait until the end of the Project. District may periodically review Project Record Documents to assure compliance with this requirement.

3.2 SUBMITTALS
   
   A. At completion of Project, deliver all Project Record Documents to District, per Section 01330 (Submittal Procedures.)

   B. Accompany submittal with transmittal letter containing:

      1. Date
      2. Project title and number
      3. Contractor’s name and address
      4. Number and title of each Project Record Document
      5. Certification that each document as submitted is complete and accurate and signature of Contractor or Contractor’s authorized representative.

END OF SECTION 01780
SECTION 01785
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. All Contract Documents shall be reviewed for applicable provisions related to the provisions in this document, and provisions in the General Conditions and other Division 1 Specification Sections shall apply to this Section without limitation.

1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS
   A. Section 01010 – “Summary of Work”
   B. Section 01310 – “Construction Scheduling”
   C. Section 01311 – “Project Management and Coordination”
   D. Section 01330 – “Submittal Procedures”
   E. Section 01740 – “Warranties and Guaranties”
   F. Section 01770 – “Contract Closeout Procedures”
   G. Section 01780 – “Project Record Documents”
   H. Divisions 2 through 33 Sections for Operation and Maintenance Data requirements for the work in those Sections.

1.3 SUMMARY
   A. This section includes administrative and procedural requirements for Operation and Maintenance (O&M) data and documents.

1.4 FORMAT
   A. Contractor shall compile O&M manuals for all building equipment including mechanical, plumbing and electrical equipment, commissioned or not, in the following formats:
      1. Quantity: as specified in Section 01330, Submittal Procedures.
      2. Hard Media Format:
         a. Size: 8 ½ x 11-inch, 3 ring loose-leaf binders. Use as many binders as required for each element as listed below. Do not overload binders.
         b. Binding: Bind in stiff, metal-hinged, three-ring binder(s) with standard 3 hole-punching. Binders shall be 3-inch maximum. Use white or black colored binders with integrated clear plastic covers to enable insertion of binder titles.
         c. Sheet lifters: Provide plastic sheet lifters prior to first page and following last page.
         d. Binder titles: Include the following title on front and spine of binder:

Contra Costa Community College District
Campus Number and Name
O&M Manual for: (insert equipment description(s) included)
3. **Drawing Size:** Provide reduced size drawings or diagrams to fit in binder. Where reduction is not practical to ensure readability, fold larger drawings separately and place in vinyl envelopes bound into the binder. Identify vinyl envelopes with drawing numbers.

4. **Dividers:** Use dividers with permanently marked tabs of card stock to separate each section and sub-section. Tab labels shall not be handwritten. Use a main tab for each specification section. Behind the section number tab there shall be the equipment ID tab sub-tab for each piece of major equipment (or group, if small or numerous). These sub-tabs shall be similar to the specification number tabs but of a different color.

**B.** Submit O&M Data specifically applicable to this Contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors shall compile and prepare data and deliver to the Contractor prior to the training of District personnel. The Contractor shall compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01330 SUBMITTAL PROCEDURES.

1. **Package Quality.** Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

2. **Package Content.** Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission.

3. **Changes to Submittals.** Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Architect or District Project Manager for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

4. **Review and Approval.** The District's Commissioning Authority (CA) shall review the commissioned systems and equipment submittals for completeness and applicability. The CA shall verify that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CA shall communicate deficiencies to the District and Architect. Upon a successful review of the corrections, the CA shall recommend approval and acceptance of these O&M manuals to the District and Architect. This work shall be in addition to the normal review procedures for O&M data.

### 1.5 ELECTRONIC MEDIA FORMAT

**A.** Electronic Media Format: Electronic media format shall be Adobe PDF, with chapter markers and/or bookmarks inserted in place of the equivalent hard copy section tabs. Electronic copy shall include all tables, charts, drawings, codes and all other matters reflected in hard copies. Electronic media files shall be delivered on a unique CD-ROM or flash drive.
1.6 SYSTEMS COVERED

A. The Contractor shall supply the required information for all systems identified in the technical specification sections and in this section. A separate manual or chapter shall be provided for each applicable system as follows:

1. Chillers
2. Cooling Towers
3. Boilers
4. Pumps
5. Air Handling Units (include sequence of operation, one-line diagram and area served in a plastic pouch for mounting on equipment or in equipment room)
6. Exhaust fans
7. Supply Air Fans (excluding Air Handling Units)
8. Plumbing and drainage Systems/Equipment
9. Emergency Generator Systems
10. UPS
11. Fire Protection Systems
12. Fire Alarm System
13. Valves and Pipe Specialties (include valve identification chart)
14. Variable Frequency Drives (VFD)
15. Smoke Control Systems
16. Water Treatment Systems
17. Elevator Systems
18. Lighting Systems and Controls (interior, exterior and airfield)
19. Switchgear, Transformers, Panel boards, Motor Control Centers and Motor Starters
20. Lighting Protection and Surge Suppression Systems
21. Public Address, Closed Circuit TV, Communication and Telephone Systems
22. Security System
23. Building Management/Temperature Control System (BMS)
24. Fuel System
25. Doors and Hardware
26. Power monitoring systems
27. HVAC, Testing Adjusting and Balancing.

1.7 COMPUTER PROGRAMS

A. When any equipment requires operation by computer programs, submit copy of original program on CD, with a hard-copy and an electronic copy (Adobe PDF format) of all user manuals and guides for operating the programs. Program shall be Windows XP compatible. Provide required licenses to District at no additional cost.

1.8 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

A. Title Page, which shall be duplicate of front binder title
B. Table of Contents with section numbers

C. Equipment Sections and Sub Sections

1. The first page behind the equipment tab shall be the Contractor’s name, address and telephone number of the manufacturer and installing contractor and the 24-hour number for emergency service for all equipment in this section, identified by equipment.

2. Submittal and Product Data: This section shall include all approved submittal data, cut sheets, data base sheets and appropriate shop drawings. If submittal was not required for approval, descriptive product data shall be included.

3. O & M and installation instructions that were shipped with the unit.

4. Model number, serial number and nameplate data for each piece of equipment and any subcomponent.

5. Safety Precautions. List personnel hazards and equipment or product safety precautions for all operating conditions.

6. Operating Instructions. These shall be the written manufacturer’s data with the model and features of this installation clearly marked and edited to omit reference to products or data not applicable to this installation. This section shall include data on the following:
   a. Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:
      i) Operator Prestart and Startup Procedures. Include step-by-step procedures, including a pre-start checklist if applicable, required to install, set up, prepare, and startup each system for use.
      ii) Startup, Shutdown, and Post-Shutdown Procedures. Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.
      iii) Sequence of operations, with detailed instruction in proper sequence, for each mode of operation (i.e. day-night; staging of equipment.)
      iv) Normal Operations. Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.
      v) Emergency Operations. Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled. If some functions of the equipment can be operated while other functions are disabled, give instructions for operations under these conditions. Include here only those alternate methods of operations (from normal) which the operator can follow when there is a partial failure of malfunctioning of components, or other unusual condition.
      vi) Shutdown procedure: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.
      vii) Refer to controls and indicators by nomenclature consistent with that used on panels and in control diagrams.
b. Operator Service Requirements. Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

c. Environmental Conditions. Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

D. Preventive Maintenance. Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1. Produce a schedule for preventive maintenance in a printed format and an electronic format compatible with District’s system. State, preferably in tabular form, the recommended frequency of performance for each preventive maintenance task, cleaning, inspection and scheduled overhauls.

2. Cleaning: Provide instructions and schedules for all routine cleaning and inspection with recommended lubricants.

3. Inspection: If periodic inspection of equipment is required for operation, cleaning or other reasons, indicate the items to be inspected and give the inspection criteria for: motors; controls; filters and any other maintenance items.

4. Provide instructions for minor repairs or adjustments required for preventive maintenance routines. Identify test points and give values for each. Include sensor calibration requirements and methods by sensor type.

5. Corrective maintenance instructions shall be predicated upon a logical effect-to-cause troubleshooting philosophy and a rapid replacement procedure to minimize equipment downtime.

6. Troubleshooting: Troubleshooting tables, charts, or diagrams shall be used to present specified procedures. A guide to this type shall be a three-column chart. The columns shall be titled: Malfunction, Probable Cause and Recommended Action.

7. Repair and replacement: Indicate repair and replacement procedures most likely to be required in the maintenance of the equipment.

8. A list of recommended spare parts with a price list and a list of spare parts provided under this Contract.

9. Outline, cross-section, and assembly drawings; engineering data; and electrical diagrams, including elementary diagrams, labeled wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.

10. Lubrication Data. Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

   a. A table showing recommended lubricants for specific temperature ranges and applications.

   b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
c. A Lubrication Schedule showing service interval frequency.

E. Corrective Maintenance (Repair). Include manufacturer’s recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1. Troubleshooting Guides and Diagnostic Techniques. Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

2. Wiring Diagrams and Control Diagrams. Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

3. Maintenance and Repair Procedures. Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

4. Removal and Replacement Instructions. Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

5. Spare Parts and Supply Lists. Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. List spare parts and supplies that have a long lead-time to obtain.

F. Appendices. Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:


2. Product Submittal Data. Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

3. Manufacturer’s Instructions. Provide a copy of all Manufacturers’ Instructions submittals required in the applicable technical sections.

4. O&M Submittal Data. Provide a copy of all Operation and Maintenance Data submittals required in the applicable technical sections.

5. Parts Identification. Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer’s standard practice. Parts data may cover more than one model or

Contra Costa Community College District
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series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

6. Warranty Information. List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

7. Personnel Training Requirements. Provide information available from the manufacturers that are needed for use in training designated personnel to properly operate and maintain the equipment and systems.

8. Testing Equipment and Special Tool Information. Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.


10. Contractor Information. Provide a list that includes the name, address, and telephone number of the Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.9 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

A. Include all requirements found in the technical specifications, items in the Schedule of O&M Data Packages, and the following for control systems:

1. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

2. Full as-built sequence of operations

3. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).

4. Full points list. A listing of rooms shall be provided with the following information for each room:
   a. Floor
   b. Room number
   c. Room name
   d. Air handler unit ID
   e. Reference drawing number
   f. Air terminal unit tag ID
   g. Heating and/or cooling valve tag ID
   h. Minimum cfm
   i. Maximum cfm

5. Full print out of all schedules and set points after testing and acceptance of the system.

6. Full as-built print out of software program.

7. Electronic copy on disk or CD of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.10 SUPPLEMENTAL DATA

A. Contractor shall prepare written text and/or special drawings to provide necessary information when manufacturer’s standard printed data is not available and/or additional information is necessary for a proper understanding and operation and maintenance of equipment or systems, or when it is necessary to supplement data included in the manual or Project documents.

1.11 SCHEDULE OF INFORMATION FOR OPERATION AND MAINTENANCE DATA PACKAGES

A. Supply all of the following, when and where applicable, for each O&M data package:
   1. Safety precautions
   2. Operator prestart
   3. Startup, shutdown, and post-shutdown procedures
   4. Normal operations
   5. Emergency operations
   6. Operator service requirements
   7. Environmental conditions
   8. Lubrication data
   9. Preventive maintenance plan and schedule
   10. Cleaning recommendations
   11. Troubleshooting guides and diagnostic techniques
   12. Wiring diagrams and control diagrams
   13. Maintenance and repair procedures
   14. Removal and replacement instructions
   15. Spare parts and supply list
   16. Special tools required to service or maintain the equipment
   17. Corrective maintenance man-hours
   18. Product submittal data
   19. O&M submittal data
   20. Parts identification
   21. Warranty information
   22. Personnel training requirements
   23. Testing equipment and special tool information
   24. Testing and performance data
   25. Installing Subcontractor information

PART 2 – PRODUCTS
Not Used.

PART 3 – EXECUTION
Not Used.

END OF SECTION 01785
SECTION 01810 / 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

Part 1 - GENERAL

1.1 SUMMARY

A. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the Owner's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:

1. Verify that the applicable equipment and systems are installed in accordance with the contact documents and according to the manufacturer's recommendations.
2. Verify and document proper integrated performance of equipment and systems.
3. Verify that Operations & Maintenance documentation is complete.
4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
5. Verify that the Owner’s operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
6. Document the successful achievement of the commissioning objectives listed above.

B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the technical sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.

C. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division Specification Sections, apply to this Section.
B. Owner's Project Requirements and Basis of Design Documentation.
C. Related Divisions and sections include the following:

1. Division 1 – General Requirements
2. Division 3 - Concrete
3. Division 7 – Thermal and Moisture Protection
4. Division 8 – Openings
5. Division 22 - Plumbing
6. Division 23 – Heating, Ventilating and Air Conditioning (HVAC)
7. Division 25 - Building Automation System
8. Division 26 – Electrical
9. Section 32 84 00 – Irrigation System
1.3 DEFINITIONS

A. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the contract documents.

B. Basis of Design (BoD) document: A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

C. Building Envelope: All parts for the exterior shell of a building that provide insulation and air and water resistance such as roofing, windows, doors, flashing, exterior water proofing, ground contact water proofing, etc.

D. Building Envelope Commissioning: A systematic process of ensuring that all building envelope systems perform interactively according to the Designer’s Basis of Design (BOD) and Owner’s Project Requirements (OPR).

E. Commissioning Plan: An overall plan developed by the CxA that provides the structure, schedule and coordination for the commissioning process.

F. Commissioning Observation: An issue identified by the Commissioning Agent or other member of the Commissioning Team that does not conform to the project OPR, contract documents or standard industry best practices. (See also Deficiency or Commissioning Issue)

G. Commissioning Process: A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated and maintained to meet the Owner’s Project Requirements.

1. Commissioning shall:
2. Verify that the applicable equipment and systems are installed according to the contract documents, manufacturer’s recommendations and industry accepted standards and they receive adequate operational checkout by installing contractors.
3. Verify and document proper performance of equipment and systems.
4. Verify O&M documentation is complete.
5. Verify that Owner’s operations and maintenance personnel are adequately trained.

H. Construction Checklist: A form used by the contractor to verify that appropriate components are on-site, ready for installation, correctly installed and functional. Also see prefuctional and functional checklists.

I. Control System: A component of environmental, HVAC, security and fire systems for reporting, monitoring and issuing of commands.

J. CxA: Commissioning Authority. The entity identified by the Owner who leads, plans, and schedules and coordinates the commissioning team to implement the commissioning process.

K. Deficiency or Commissioning Issue: A condition identified by the Commissioning Agent or other member of the Commissioning Team that adversely affects the commissionability, operability, maintainability, or functionality of a system, equipment, or component. A condition that is in conflict with the Contract Documents and/or performance requirements of the installed systems and components.

L. Factory Testing: Testing of equipment on-site or at the factory by factory personnel with or without owner’s representative present.

M. Functional Performance Testing (FPT): Generally, refers to testing of a complete system and demonstrates control of equipment and the interaction of equipment or systems. Performed by the contractor and witnessed by the CxA.
N. Installation Verification: Observations or inspections that confirm the system or component has been installed in accordance with the contract documents and to industry accepted best practices.

O. Integrated System Testing: Integrated Systems Testing procedures entail testing of multiple integrated systems performance to verify proper functional interface between systems. Typical Integrated Systems Testing includes verifying that building systems respond properly to loss of utility, transfer to emergency power sources, re-transfer from emergency power source to normal utility source; interface between HVAC controls and Fire Alarm systems for equipment shutdown, interface between Fire Alarm system and elevator control systems for elevator recall and shutdown; interface between Fire Alarm System and Security Access Control Systems to control access to spaces during fire alarm conditions; and other similar tests as determined for each specific project.

P. Master Issues Log: A formal and ongoing record of problems or concerns and their resolution that have been raised by members of the commissioning team during the course of the commissioning process. Maintained by the CxA.

Q. Owner’s Project Requirements (OPR): A collection of documents that details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

R. Owner: Project Owner or designated representative.

S. Pre-functional Checklists (PFC): Refers to checklists prepared by the CxA and provided to the contractor to document the complete installation of equipment or systems. Pre-functional checklists are completed by the contractors prior to start-up.

T. Pre-Functional Test (PFT): An inspection or test that is done before functional testing. PFT’s include installation verification and system and component start up tests.

U. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.

V. Seasonal Performance Tests: Functional Tests that are deferred until the system(s) will experience conditions closer to their design conditions.

W. Site Observation Visit: On-site inspections and observations made by the Commissioning Agent for the purpose of verifying component, equipment, and system installation, to observe contractor testing, equipment start-up procedures, or other purposes.

X. Site Observation Reports (SO): Reports of site inspections and observations made by the Commissioning Agent. Observation reports are intended to provide early indication of an installation issue which will need correction or analysis.

Y. Start-up: The initial starting or activating of dynamic equipment.

Z. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

AA. TAB: A systematic process or service applied to heating, ventilating and air-conditioning (HVAC) systems and other environmental systems to achieve and document air and hydronic flow rates. The standards and procedures for providing these services are referred to as “Testing, Adjusting, and Balancing” and are described in the Procedural Standards for the Testing, Adjusting and Balancing of Environmental Systems, published by NEBB or AABC.

BB. Training Plan: A written document that details the expectations, schedule and deliverables of commissioning process activities related to training of project operating and maintenance personnel, users and occupants.

CC. Trending: The monitoring by a building management system or other electronic data gathering equipment and analyzing of the data gathered over a period of time to verify proper equipment or systems sequence of operations.

DD. Verification: The process by which specific documents, components, equipment, assemblies, systems and interfaces among systems are confirmed to comply with the criteria described in the contract documents. Verification testing is performed by the contractor and witnessed by the CxA.
EE. Warranty Phase Commissioning: Commissioning efforts executed after a project has been completed and accepted by the Owner. Warranty Phase Commissioning includes follow-up on verification of seasonal system performance, assistance in identifying warranty issues and enforcing warranty provisions of the construction contract.

FF. Warranty Visit: A commissioning meeting and site review where all outstanding warranty issues and deferred testing is reviewed and discussed.

1.4 COMMISSIONING TEAM

A. Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Construction Managers, General Contractor, Subcontractors, Vendors, third party testing agencies, etc.) is essential to the success of the Commissioning effort.

B. The members of the commissioning team consist of the contracted commissioning agent (CxA), the owner's representative/construction manager (PM/CM), the general contractor (GC), the general contractor's commissioning coordinator (CxC), the architect and design engineers (AE), the mechanical contractor (MC), the electrical contractor (EC), the controls contractor (CC), the testing and balancing contractor (TAB), the facility operating staff and any other installing subcontractors, suppliers of equipment or specialists. The contracted CxA is hired by the owner directly. The CxA directs and coordinates the project commissioning activities and the reports to the owner. All team members work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

C. The prime contractor shall in addition to their representative also appoint a representative from each subcontractor involved in commissioned systems including mechanical, electrical, controls, test and balance and plumbing.

D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Construction Project Manager (PM/CM). Thus, the procedures outlined in this specification must be executed within the following limitations:

1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the District (Contra Costa County Community College District) and the Contractor.

2. Commissioning Issues identified by the Commissioning Agent will be delivered to the Construction Manager and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.

3. In the event that any Commissioning Issues and suggested resolutions are deemed by the Construction Manager to require either an official interpretation of the construction documents or require a modification of the contract documents, the Construction Manager will issue an official directive to this effect.

4. All parties to the Commissioning Process shall be individually responsible for alerting the Construction Manager of any issues that they deem to constitute a potential contract change prior to acting on these issues.

5. Authority for resolution or modification of design and construction issues rests solely with the Construction Manager, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

1.5 OWNER’S RESPONSIBILITIES
A. Participate in resolution of issues that may occur as a result of the commissioning process.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:

1. Coordination meetings.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Testing meetings.
4. Demonstration of operation of systems, subsystems, and equipment.

1.6 CONTRACTOR’S AND SUBCONTACTOR’S RESPONSIBILITIES

A. Provide utility services required for the commissioning process.

B. Contractor is responsible for construction means, methods, job safety, or management function related to commissioning on the job site.

C. Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Attend a commissioning kick-off/scoping meeting and other necessary meetings scheduled by the CxA to facilitate the Cx process.
2. Participate in construction-phase commissioning meetings including controls coordination meeting to review and resolve any issues with the sequence of operations.
3. Provide detailed start-up procedures.
4. Participate in maintenance orientation and inspection.
5. Participate in operation and maintenance training sessions.
6. Certify that Work is complete, and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
7. Perform quality control of all work and certify it is complete prior to request for inspection.
8. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.

D. The GC will be required to maintain a commissioning schedule that is updated periodically during the commissioning process and is presented and discussed at the commissioning meetings.

E. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in construction-phase coordination meetings.
2. Participate in maintenance orientation and inspection.
3. Complete pre-functional checklists for all equipment. Submit completed forms with start-up reports immediately after start up. The CxA may request further documentation necessary for the commissioning process.
4. Participate in procedures meeting for testing.
5. Participate in final review at acceptance meeting.
6. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to CxA for incorporation into the commissioning plan. Update schedule on a weekly basis throughout the construction period.
7. Provide a copy of the O&M manual submittals of commissioned equipment, through normal channels, to the CxA for review and approval. O&Ms are required to be submitted and approved at least one month prior to training.
8. Provide information to the CxA for developing construction-phase commissioning plan.
9. Participate in training sessions for operation and maintenance personnel.
10. Verify that all systems function correctly by testing each mode of operation, alarm and system function.
11. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified.
12. Perform quality control of all work and certify it is complete prior to request for inspection.
13. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures and participate in testing of installed systems, subsystems, and equipment.
14. Provide updated Project Record Documents or Shop Drawings to the CxA.

1.7 MECHANICAL CONTRACTOR'S RESPONSIBILITIES
A. Responsibilities listed in Section 1.06 above.
B. Completely install and thoroughly inspect, startup, test, adjust, balance, and document all systems and equipment.
C. Assist CxA in verification and performance testing. Assistance will generally include the following:
   1. Review CxA provided prefunctional and functional performance test documents and provide written comments.
   2. Demonstrate system operation.
   3. Manipulate systems and equipment to facilitate testing.
   4. Provide specialized instrumentation necessary for verification and performance testing.
D. Perform seasonal testing, at the direction of the CxA, to prove functional performance of the HVAC and controls in the opposite season.
E. Schedule and perform duct air leakage testing as specified in the technical specification sections with CxA as witness.
F. Provide flushing plans, disinfection reports and water treatment reports to the CxA for review.
G. Participate in pre-TAB meeting and jobsite inspections to verify TAB readiness.
H. Provide draft completed TAB report to CxA for review. CxA will identify up to 20% of TAB report for TAB contractor to demonstrate compliance to the completed TAB report.
I. Provide a copy of the O&M manual submittals of commissioned equipment, through normal channels, to the CxA for review and approval. O&Ms are required to be submitted and approved at least one month prior to training.

1.8 CONTROLS CONTRACTOR'S RESPONSIBILITIES
A. Responsibilities listed in Section 1.06 above.
B. Completely install and thoroughly inspect, startup, test, adjust, balance, and document all systems and equipment.
C. Assist CxA in verification and performance testing. Assistance will generally include the following:
   1. Establish trend logs of system operation as specified herein.
   2. Demonstrate system operation.
   3. Manipulate systems and equipment to facilitate testing.
   4. Provide specialized instrumentation necessary for verification and performance testing.
   5. Manipulate control systems to facilitate verification and performance testing.
   6. Provide trend reports of all points designated by the CxA and District for 1 week following successful performance testing, at intervals to be provided by the CxA, once the final BAS points list is established by the contractor.
D. Sequences of Operation and Control Logic Submittals: The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for
each piece of equipment, regardless of the completeness and clarity of the sequences in the Specifications. They shall include:

1. An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.
2. All interactions and interlocks with other systems.
3. Detailed delineation of control between any packaged controls and the Building Automation System (BAS), listing what points the BAS monitors only and what BAS points are control points and are adjustable.
4. Written sequences of control for packaged controlled equipment. (Equipment manufacturers’ stock sequences may be included but will generally require additional narrative).
5. Start-up sequences.
6. Warm-up mode sequences.
7. Normal operating mode sequences.
8. Unoccupied mode sequences.
10. Capacity control sequences and equipment staging.
11. Temperature and pressure control: setbacks, setups, resets, etc.
12. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
13. Effects of power or equipment failure with all standby component functions.
15. Seasonal operational differences and recommendations.
16. Initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
17. Schedules.
18. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.
19. Provide documentation of all site-specific programming as well as programming manual to CxA for review. Logic shall include all line code, function block templates with associated logic, graphical logic diagrams, etc. as applicable to the control system.

E. Control Drawings Submittal

1. The control drawings shall have a key to all abbreviations.
2. The control drawings shall contain graphic schematic depictions of the systems and each component.
3. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
4. Provide a full points list with at least the following included for each point:
   a. Controlled system
   b. Point abbreviation
   c. Point description DB temp, airflow, etc.
   d. Display unit
   e. Control point or Setpoint: Point that controls equipment and can have its setpoint changed (OSA, SAT, etc.).
   f. Monitoring point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.
g. Intermediate point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).

h. Calculated point: “Virtual” point generated from calculations of other point values.

F. The Controls Contractor shall keep the CxA informed of all changes to this list during programming and setup.

G. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.

H. Controls point to point checkout will require documentation of specific set up and calibration parameters for each point and controller such as measured value versus displayed value at various ranges, stroke and range adjustments, adjusted and actual trip points of switches, alarm thresholds, etc. A simple binary indication that a point-to-point checkout has been accomplished is not acceptable to document the point checkout.

I. Assist and cooperate with the TAB contractor in the following manner:
   1. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
   2. For a given area, have all required prefunctional checklists, calibrations, start-up and selected functional tests of the system completed and approved by the CxA prior to TAB.
   3. Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB or provide sufficient training for TAB to operate the system without assistance.

J. The Controls Contractor shall expand on the prefunctional and functional testing plans to incorporate a comprehensive checkout of the control system.

K. Provide a signed and dated certification to the CxA and CM/CxC upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.

L. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).

M. Provide building automation systems controls trend reports as requested by the CxA as part of functional testing.

N. Warranty Period
   1. Execute seasonal or deferred functional performance testing, witnessed by the CxA, according to these specifications.
   2. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

1.9 ELECTRICAL CONTRACTOR’S RESPONSIBILITIES

A. Responsibilities listed in Section 1.06 above.

B. Construction and Acceptance Phases
   1. Contractors shall provide normal cut sheets and shop drawing submittals to the CxA of commissioned equipment.
   2. Provide additional requested documentation, prior to normal O&M manual submittals, to the CxA for development of start-up and functional testing procedures.
      a. Typically, this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any
Owner-contracted tests, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up, and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CxA.

b. The CxA may request further documentation necessary for the commissioning process.

c. This data request may be made prior to normal submittals.

3. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the Specifications, control drawings or equipment documentation are not sufficient for writing detailed testing procedures.

4. Provide assistance to the CxA in preparation of the specific functional performance test procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

5. Develop a full start-up and initial checkout plan using manufacturer’s start-up procedures and the prefunctional checklists from the CxA. Submit manufacturer’s detailed start-up procedures and the full start-up plan and procedures and other requested equipment documentation to CxA for review.

6. During the start-up and initial checkout process, execute and document the electrical-related portions of the prefunctional checklists provided by the CxA for all commissioned equipment.

7. Perform and clearly document all completed start-up and system operational checkout procedures, providing a copy to the CxA.

8. Address current A/E punch list and Cx Issues Log items before performing functional performance testing.

9. Provide skilled technicians to execute starting of systems and equipment and to assist in the functional performance tests. Ensure that they are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.

10. Correct deficiencies (differences between specified and observed performance) as interpreted by the CxA, CxC and A/E and retest the equipment.

11. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

12. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (include deferred testing).

13. Provide training of the Owner’s operating personnel as specified.

14. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

1.10 EQUIPMENT SUPPLIER’S RESPONSIBILITIES

A. The equipment suppliers shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Assist in equipment testing per agreements with Subcontractors.

2. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

3. Review test procedures for equipment installed by factory representatives.

4. Attend commissioning kickoff meetings and additional meetings as necessary.

5. Contracted to General or Subcontractor.
1.11 ARCHITECT AND DESIGN ENGINEER’S RESPONSIBILITIES

A. Responsible for developing the construction contract documents and clarifying the design intent during the construction phase of the project.
B. Provides the Basis of Design document.
C. Performs construction observation.
D. Contracted directly to OWNER.

1.12 CxA’s RESPONSIBILITIES

A. Organize and lead the commissioning team.
B. Prepare a Commissioning Plan. Collaborate with design team, owner, contractor and subcontractors to develop test procedures. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.
C. Work with the Contractor to schedule commissioning activities. The Contractor shall integrate all commissioning activities into the master construction schedule. All parties will address scheduling issues in a timely manner in order to expedite the commissioning process.
D. Review and comment on submittals for compliance with the approved project documents and identify any potential conflicts.
E. Conduct commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. The CxA shall prepare and distribute minutes to commissioning team members and attendees within five (5) workdays of the commissioning meeting.
F. At the beginning of the construction phase, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for permanent power; operation and maintenance data submittals; operation and maintenance training sessions; TAB Work; and Project completion.
G. Develop an enhanced start-up and initial systems checkout plan with contractors.
H. Periodically observe and inspect construction and report progress and deficiencies. In addition to compliance with the Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.
I. Prepare Project-specific pre-functional checklists and functional test procedures checklists.
J. Witness HVAC piping pressure testing and flushing, ductwork pressure testing and final cleaning and major systems start-up.
K. Witness and document functional performance testing.
L. Compile test data, inspection reports, and certificates and include them in the Systems Manual and Commissioning Report.
M. Review and comment on operation and maintenance documentation for compliance with the Contract Documents and adequacy for Owner training.
N. Review Contractor’s operation and maintenance training program.
O. Prepare commissioning status reports.
P. Assemble the final commissioning documentation, including the Commissioning Report and Systems Manual including applicable Project Record Documents.

1.13 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: A document, prepared by CxA, that outlines the process, schedule, allocation of resources, and documentation requirements of the commissioning effort, and shall include, but is not limited to the following:

1. Description of the organization, layout, and content of commissioning documentation to be provided along with identification of responsible parties.
2. Identification of systems and equipment to be commissioned.
3. Description of the level of commissioning for each system
4. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.
5. Identification of items that must be completed before the next operation can proceed.
6. Description of responsibilities of commissioning team members.
7. Description of observations to be made.
8. Description of requirements for operation and maintenance training, including required training materials.
9. Provide a schedule for key commissioning activities with specific dates coordinated with overall construction schedule.
10. Define the process for completing prefunctional and startup checklists for systems, subsystems, and list of specific equipment requiring these checklists.
11. Include Step-by-step procedures for Functional testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.

B. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will review Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.

C. Start-Up Reports: Contractor/Manufacture created forms that document that factory start-up procedures have been followed for all equipment and systems to be commissioned. Provided by sub-contractors and included as part of the Cx Plan.

D. Functional Performance Testing: CxA shall develop functional performance test procedures for all equipment and systems to be commissioned with input from installing contractors.

E. Site Visit Reports: CxA shall record test data, observations, and measurements on site visit forms. Photographs and other means appropriate for the application shall be included with data.

F. Test and Inspection Reports: CxA shall compile relevant test and inspection reports and test and inspection certificates and include them in Systems Manual and Commissioning Report.

G. Commissioning Schedule: CxA shall review and provide input to the master project and construction schedules for commissioning activities. Contractor shall incorporate all commissioning activities into the construction schedule.

H. Cx Issues Log: CxA shall prepare and maintain an issue log that describes installation, and performance issues that are at variance with the Contract Documents. CxA will identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

1. Creating a Cx Issues Log Entry:
   a. Identify the issue with a unique numeric identifier by which the issue may be tracked.
   b. Assign a descriptive title of the issue.
   c. Identify issue date and author.
   d. Identify test number of tests being performed at the time of the observation, if applicable, for cross-reference.
   e. Identify system, subsystem, and equipment to which the issue applies.
   f. Identify location of system, subsystem, and equipment.
   g. Include information that may be helpful in diagnosing or evaluating the issue.
   h. Note recommended corrective action.
   i. Identify commissioning team member responsible for corrective action.
j. Identify persons responding to the issue.

2. Documenting Issue Resolution:
   a. Log date issue is closed; issue may be closed and unresolved.
   b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
   c. Identify changes to the Contract Documents that may require action, if any.
   d. State that correction was completed, and system, subsystem, and equipment are ready for retest, if applicable.
   e. Identify person(s) who corrected or resolved the issue.
   f. Identify person(s) documenting the issue resolution.

I. Commissioning Report: CxA shall document results of the commissioning process including performance of systems, subsystems, equipment and issues. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the Owner’s Design Intent and Contract Documents. The commissioning report shall include, but is not limited to, the following:

1. Discussion of performance of commissioned systems including any variance from the design intent and the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.
2. Test plans and reports.
3. Submittal Review Comments
4. Cx Issues log.
5. Completed prefunctional and functional test checklists.
6. Completed start-up reports
7. Listing of off-season test(s) not performed and a schedule for their completion.
8. Training Records

J. Systems Manual: CxA shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:

1. Owner’s Project Requirements
2. Basis of Design or Design Narrative
3. As-built system narratives, schematics, and list of installed equipment.
4. Operation and maintenance data.
5. Re-commissioning forms and schedule for each Cx system.

1.14 SUBMITTALS

A. Commissioning Plan: CxA shall submit a draft commissioning plan. Deliver one copy to Contractor and one to Owner. Present submittal in sufficient detail to evaluate data collection and arrangement process. One copy, with review comments, will be returned to the CxA for preparation of the final commissioning plan.

B. Prefunctional Checklists: CxA shall submit sample checklists and forms to Contractor and subcontractors for review and comment.

C. Construction Checklists for Enclosure Commissioning: CxA shall submit sample Construction Checklists to Contractor for review. Contractor will complete the Construction Checklists prior to requesting CxA witnessing of Contractor provided tests.

D. Start-Up Forms: Contractor shall submit start up forms to be used during construction for all equipment and systems to be commissioned for CxC and CxA Review.

E. Functional Test Plan: CxA shall submit draft Functional Test Plan for comment. The final Functional Test Plan will be submitted and used for functional testing.
F. Site Observation Reports: CxA shall submit site visit reports within two days of the site visit documenting areas observed and any deficiencies noted.

G. Final Commissioning Report: CxA shall submit the draft commissioning report. One copy, with review comments, will be returned to the CxA for preparation of final submittal. The final report submittal must address previous review comments.

H. The CxA will provide appropriate contractors with a specific request for the type of submittal documentation the CxA requires facilitating the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum the request will include the manufacturer and model number, the manufacturer printed installation and detailed start-up procedures, sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details. In addition, the factory checkout sheets or field technicians shall be submitted for review.

I. The CxA will review submittals related to the commissioned equipment and systems for conformance with the contract documents as it relates to commissioning process, to the performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional test performance procedures. The CxA will notify the PM/CM and CxC of items missing or areas that are not in conformance with contract documents and which require resubmission.

J. BAS Trend Reports: The controls subcontractor shall submit 1 week of trend reports with the control system in “auto” without alarms after functional performance testing is completed and all issues are resolved to demonstrate stability and proper control sequences. Trended points and time intervals to be determined by the CxA.

K. Test and Inspection Reports: Contractor shall submit test and inspection reports and start-up reports for review by the CxA. This includes, but is not limited to, controls calibration report, point to point report and checkout reports.

1.15 QUALITY ASSURANCE

A. Training Instructor Qualifications: Factory-authorized service representatives experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

B. Test Equipment Calibration:
   1. Comply with test equipment manufacturer’s calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.
   2. All test equipment required to perform start-up and initial checkout and required performance testing shall be provided by the contractor for the equipment being tested.
   3. The following minimum requirements apply if not noted in the specifications: temperature sensors and digital thermometers shall carry a current certified calibration to an accuracy of .5 degrees F and resolution of +/- .1-degree F; pressure sensors shall have an accuracy of +/- 2% of the value range being measured and have been calibrated within the last year. All equipment shall be calibrated per the manufacturer’s recommended intervals. Calibration tags shall be affixed or certificates readily available.

C. TAB Verification: TAB contractor shall use same equipment used to perform testing, adjusting and balancing for demonstrating up to 20% of the TAB report for CxA verification. Calibration certificates will be reviewed for each piece of test equipment.

1.16 COORDINATION

A. Scheduling: The Contractor shall work with the Commissioning Agent and the PM/CM to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks,
durations and predecessors) on commissioning activities to allow the Contractor and the CM to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction schedule as directed by the CM.

B. Coordinating Meetings: CxA shall conduct coordination meetings with the commissioning team as needed to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

C. Pretesting Meetings: CxA shall conduct pretest meetings with the commissioning team to review startup reports, coordinate controls sequence of operations, review pretest inspection results, review testing and balancing procedures, review testing personnel and instrumentation requirements, and manufacturers’ authorized service representative services for each system, subsystem, equipment, and component to be tested.

D. Testing Coordination: CxA shall coordinate with the Owner and Contractor to plan the sequence of testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Contractor shall schedule times for tests, inspections, obtaining samples, and similar activities.

Part 2 - PRODUCTS

2.1 INSTRUMENTATION AND TEST EQUIPMENT

A. Instrumentation required to verify readings and test system and equipment performance shall be provided by Contractor and made available to Commissioning Authority. Generally, no testing equipment will be required beyond that required to perform Contractors work under these Contract Documents. All equipment used for testing and calibration shall be NIST/NBS traceable and calibrated within the preceding 1-year period. Certificates of calibration shall be submitted to CxA for review.

2.2 TAB & Cx OPERATORS TERMINAL AND SOFTWARE

A. Contractor shall provide a portable operators terminal or hand-held device and all software required to facilitate TAB and calibration and functional testing to TAB contractor. This device shall support all functions and allow querying and editing of all parameters required for proper calibration and start up, viewing real time point information, set up and view trends, view program logic, etc.

B. BAS Temporary Graphical User Interfaces for Commissioning: Provide fully featured graphical user interfaces in all major mechanical rooms to facilitate Cx. Interfaces to eventually be relocated may be used. Contractor shall secure hardware from damage and theft as applicable. CxA shall be provided required hardware and software access.

1. BAS shall ensure that all real time point information for HVAC zones, including those that include multiple controllers (such as tracking zones) can be accessed by provided tools within the zone through one communication port in that zone.

2. The system shall be capable of recording and storing historical trend data at the time of functional testing for use in evaluating performance of the system.
### Part 3 - EXECUTION

#### 3.1 COMMISSIONED SYSTEMS

<table>
<thead>
<tr>
<th>System</th>
<th>Equipment</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HVAC</strong></td>
<td>Air Handling Unit</td>
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</tr>
<tr>
<td></td>
<td>Make-Up Air Unit</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Circulating Pumps</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Exhaust Fans</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Variable Frequency Drives</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Ductwork – Leakage Testing</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Variable Air Volume Terminal Units</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Test and Balance Report</td>
<td>3</td>
</tr>
<tr>
<td><strong>Direct Digital Control System</strong></td>
<td>Sequences of operation, monitored points, and alarms</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Metering/monitoring devices and equipment</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Software commissioning, GUI presentation, system access performance criteria, software tools/source code commissioning, instrument data sheets, middleware commissioning, Internet Protocol commissioning</td>
<td>5</td>
</tr>
<tr>
<td><strong>Building Enclosure</strong></td>
<td>Foundations/Slabs</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Wall Systems</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Roof Systems</td>
<td>3</td>
</tr>
<tr>
<td><strong>Plumbing</strong></td>
<td>Gas Water Heaters</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Recirculation Pump &amp; Controls</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Temperature Mixing Valves</td>
<td>3</td>
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<tr>
<td></td>
<td>Plumbing Fixtures</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Emergency Plumbing Fixtures</td>
<td>5</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td>Daylighting Controls</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Occupancy Sensors</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Scheduled Lighting Controls</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Exterior Lighting Controls</td>
<td>5</td>
</tr>
</tbody>
</table>
### System
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landscape Irrigation Control</td>
<td>5</td>
</tr>
<tr>
<td>Irrigation Zone Coverage</td>
<td>3</td>
</tr>
</tbody>
</table>

**Level 1** The CxA will periodically observe and inspect the installation of building systems and may review project documentation to verify operational requirements meet the design intent/OPR.

**Level 2** The CxA will perform Level 1 activities and inspect, test or operate portions of the system to verify operational requirements are met. These activities may be performed independently of the contractor.

**Level 3** The CxA will perform Level 2 activities and will witness contractor performance testing of up to 20% of the system to prove operational requirements are met. The test sections shall be chosen at random by the CxA to ensure uniformity of system.

**Level 4** The CxA will perform Level 2 activities and will witness contractor performance testing of up to 50% of the system to prove operational requirements are met. The test sections shall be chosen at random by the CxA to ensure uniformity of system.

**Level 5** The CxA will perform Level 2 activities and will witness contractor performance testing of up to 100% of the system to prove operational requirements are met.

### 3.2 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

A. The following procedures apply to all equipment and systems to be commissioned.

B. Prefunctional Checklists are developed by the CxA and completed by the appropriate installing contractors for all major equipment and systems being commissioned before functional testing can begin. The checklist captures equipment nameplate and characteristics data, location & service areas, and confirms the as-built status of the equipment or system. These checklists also ensure that the systems are complete and operational, so that the functional performance testing can be scheduled. The Contractor and vendors shall execute factory startup and provide the CxA with a copy of the signed and dated completed start-up checklists which will be submitted with the Prefunctional checklists.

C. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.

D. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer’s detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

1. The full startup plan shall at a minimum consist of the following items:
   a. The Pre-Functional Checklists.
   b. The manufacturer’s standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
   c. The manufacturer’s normally used field checkout sheets.

E. The Commissioning Agent will review/approve the full start-up plan.

F. The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.

G. Execution of Prefunctional Checklists and Startup.
1. 2 weeks prior to start-up, sub-contractors and vendors schedule startup and checkout with the PM/CM, CxC, and CxA. The performance of the startup and checkout shall be directed and executed by the CxC.

2. The contractor shall maintain a master copy of signed checklists.

3. The installing contractors shall update the checklists as work is completed. Only individuals that have direct knowledge and witnessed that a line item task on the pre-functional checklist was actually performed shall initial or check that item off.

4. The CxA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are repetitive multiple units, (in which case a sampling strategy may be used as approved by the Owner).

5. The CxA will periodically review the checklists for completeness and report on progress at the Cx meetings.

H. BAS (and other similar control systems) Startup Testing, Adjusting, and Calibration

1. Work and/or systems installed under this Division shall be fully functioning prior to Demonstration and Acceptance Phase. Contractor shall start, test, adjust, and calibrate all work and/or systems under this Contract, as described below:

   a. Inspect the installation of all devices. Review the manufacturer’s installation instructions and validate that the device is installed in accordance.

   b. Verify proper electrical voltages and amperages and verify that all circuits are free from faults.

   c. Verify integrity/safety of all electrical connections.

   d. Coordinate with TAB subcontractor to obtain and CxA to fine tune control settings that are determined from balancing and testing procedures. Record the following control settings as obtained from TAB contractor, and note any TAB deficiencies in the BAS, Pre-functional checklists and initiate an associated Action Item:

      i. Optimum duct static pressure setpoints for VAV air handling units.

      ii. Minimum outside air damper settings for air handling units.

      iii. Optimum differential pressure setpoints for variable speed pumping systems.

      iv. Calibration parameters for flow control devices such as VAV boxes and flow measuring stations.

      v. BAS contractor shall provide hand held device as a minimum to the TAB and CxA to facilitate calibration. Connection for any given device shall local to it (i.e.: at the VAV box or at the thermostat). HHD or portable operator’s terminal shall allow querying and editing of parameters required for proper calibration and start up.

   e. Test, calibrate, and set all digital and analog sensing, and actuating devices. Calibrate each instrumentation device by making a comparison between the BAS display and the reading at the device, using an instrument traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be calibrated (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range). Record the measured value and displayed value for each device in the BAS Pre-functional Report.

   f. Check and set zero and span adjustments for all transducers and transmitters.

   g. For dampers and valves:

      i. Check for adequate installation including free travel throughout range and adequate seal.
ii. Where loops are sequenced, check for proper control without overlap

h. For actuators:
   i. Check to ensure that device seals tightly when the appropriate signal is applied to the operator.
   ii. Check for appropriate fail position, and that the stroke and range is as required at operating pressures/conditions.
   iii. For sequenced electronic actuators, calibrate per manufacturer's instructions to required ranges.

i. Check each digital control point by making a comparison between the control command at the controller and the status of the controlled device. Check each digital input point by making a comparison of the state of the sensing device and the OI display. Record the results for each device in the BAS Pre-functional checklists.

j. For outputs to reset other manufacturers devices (VSDs) and feedback from them, calibrate ranges to establish proper parameters. Coordinate with representative of the respective manufacturer and obtain their approval of the installation.

k. Verify proper sequences by using the approved checklists to record results and submit with BAS Pre-functional checklists. Verify proper sequence and operation of all specified functions. There is inherent duplication between the functional performance testing of the Testing Contractor, and the thorough checking testing of the sequences by the BAS. Generally, the sequence checkouts indicated as the responsibility of the Testing Contractor under functional testing, must first be tested by the BAS under prefunctional testing.

l. Verify proper systems operation under emergency power. Cooperate and coordinate with Testing Contractor and CxA for comprehensive building power outage tests.

m. Verify all safety devices trip at appropriate conditions. Adjust setpoints accordingly.

n. Verify that all alarm thresholds for all analog devices are entered. Request direction from Owner as to alarm threshold parameters

o. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the BAS Prefunctional Report. Except from a startup, maximum allowable variance from set point for controlled variables under normal load fluctuations shall be as follows. Within 2 minutes of any upset (for which the system has the capability to respond to) in the control loop, tolerances shall be maintained (exceptions noted):
   i. Duct air temperature: ±1°F.
   ii. Space Temperature: ±2°F
   iii. Chilled Water: ±1°F
   iv. Hot water temperature: ±2°F.
   v. Duct pressure: ± 0.25” w.g.
   vi. Water pressure: ±1 psid
   vii. Duct or space Humidity: ±5%
   viii. Air flow control: ±5% of setpoint velocity. For min OA flow loops being reset from CO2, response to upset max time is one hour
   ix. Space Pressurization (on active control systems): ±0.02” wg with no door or window movements

p. For interface and DDC control panels:
i. Ensure devices are properly installed with adequate clearance for maintenance and clearly labeled in accordance with the record drawings

ii. Ensure terminations are safe, secure and labeled in accordance with the record drawings

iii. Check power supplies for proper voltage ranges and loading.

iv. Ensure wiring and tubing are run in a neat and workman-like manner, either bound or enclosed in trough.

v. Check for adequate signal strength on communication networks.

vi. Check for stand-alone performance of controllers by disconnecting the controller from the LAN. Verify the event is enunciated at OIs. Verify that the controlling LAN reconfigures as specified in the event of a LAN disconnection.

vii. Ensure that controller memory and control network through-put are adequate to support the extensive trending requirements. Reconfigure the system to provide a reliable and robust system as necessary.

viii. Ensure all outputs and devices fail to their proper positions/states.

ix. Ensure buffered and/or volatile information is held through power outage.

x. With all system and communications operating normally, sample and record update/enunciation times for critical alarms fed from the panel to the OI.

xi. Check for adequate grounding of all DDC panels and devices.

q. For Operator Interfaces:

i. Verify all elements on the graphics are functional and properly bound to physical devices and/or virtual points and that hot links or page jumps are functional and logical.

ii. Output all specified system reports for review and approval.

iii. Verify the alarm printing and logging is functional and per requirements

iv. Verify trend archiving to disk and provide a sample to the CxA for review.

v. Verify paging/dial out alarm enunciation is functional.

vi. Verify functionality of remote OIs and that a robust connection can be established consistently.

vii. Verify that required third party software applications required with the bid are installed and functional.

viii. Start up and check out control air compressors and air drying and filtering systems in accordance with the appropriate section and manufacturer’s instructions.

ix. Verify proper interface with fire alarm system.

r. Submit Start-Up Test Report. Report shall be completed, submitted and approved prior to functional testing.

I. Sensor and Actuator Calibration. All field-installed temperature, relative humidity, CO, CO2, refrigerant, O2, and/or pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated. Verify that all locations are appropriate and away from causes of erratic operation. Submit to the CxA through the PM/CM the calibration methods and results. All test instruments shall have had a current certified calibration record. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated. Contractor to field verify all installed sensors.

1. Sensor Calibration Methods
a. All Sensors: Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable, are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within specifications of each other for temperature and for pressure. Tolerances for critical applications may be tighter.

b. Sensors without Transmitters: Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

c. Sensors with Transmitters: Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

2. Tolerances, Standard Applications (if not stated in the specifications):

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Required Tolerance (+/-)</th>
<th>Sensor</th>
<th>Required Tolerance (+/-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling coil, chilled and condenser water temps</td>
<td>0.4F</td>
<td>Flow rates, water</td>
<td>4% of design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relative humidity</td>
<td>4% of design</td>
</tr>
<tr>
<td>AHU wet bulb or dew point</td>
<td>2.0F</td>
<td>Combustion flue temps</td>
<td>5.0F</td>
</tr>
<tr>
<td>Hot water coil and boiler water temp</td>
<td>1.5F</td>
<td>Oxygen or CO₂ monitor</td>
<td>0.1 % pts</td>
</tr>
<tr>
<td>Outside air, space air, duct air temps</td>
<td>0.4F</td>
<td>CO monitor</td>
<td>0.01 % pts</td>
</tr>
<tr>
<td>Watthour, voltage &amp; amperage</td>
<td>1% of design</td>
<td>Natural gas and oil flow rate</td>
<td>1% of design</td>
</tr>
<tr>
<td>Pressures, air, water and gas</td>
<td>3% of design</td>
<td>Barometric pressure</td>
<td>0.1 in. of Hg</td>
</tr>
<tr>
<td>Flow rates, air, water</td>
<td>10% of design</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Valve and Damper Stroke Setup and Check BAS Readout: For all valve and damper actuator positions checked, verify the actual position against the BAS readout. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn’t reasonably correspond, repair or replace actuator.

4. Closure for heating coil valves (NO): Set heating setpoint 20°F above room temperature. Observe valve open. Remove control air or power from the valve and verify that the valve stem and actuator position are as specified. Restore to normal. Set heating setpoint to 20°F below room temperature. Observe the valve close. Restore setpoints to normal.

5. Closure for cooling coil valves (NC): Set cooling setpoint 20°F above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position are as specified. Restore to normal. Set cooling setpoint to 20°F below room temperature. Observe valve open. Restore setpoints to normal.

J. Loop Tuning
1. For all control loops, contractor shall tune the loops to ensure the fastest stable response without hunting, offset or overshoot within tolerances specified above. Contractor shall introduce upsets to the load when possible to affect response. Otherwise, setpoints can be changed to affect the response.

2. Generally, tune loops during periods of high gain.

3. Document all parameters either by capturing text, short interval trends, or screen shots of trend graph documenting the final response.

K. Valve Stroke Setup and Check

1. For all valve and actuator positions checked, verify the actual position against the OI readout.

2. Set pumps or fans to normal operating mode. Command valve or damper closed, verify that device is closed and adjust output zero signal as required. Command device open, verify position is full open and adjust output signal as required. Command valve to a few intermediate positions. If actual valve position doesn't reasonably correspond, adjust spring tension, replace actuator or add pilot positioner (for pneumatics).

L. Coil Valve Leak Check

1. Verify proper close off of the valves. Ensure the valve seats properly by simulating the maximum anticipated pressure difference across the circuit. Calibrate air temperature sensors on each side of coil to be within 0.5°F of each other. Via the OI, command the valve to close. Energize fans. After 5 minutes observe air temperature difference across coil. If a temperature difference is indicated, and the piping surface temperature entering the coil is within 3°F of the water supply temp, leakage is probably occurring. If it appears that it is occurring, close the isolation valves to the coil to ensure the conditions change. If they do, this validates the valve is not closing. Remedy the condition by adjusting the stroke and range, increasing the actuator size/torque, replacing the seat or replacing the valve as applicable.

M. Deficiencies, Non-Conformance and Approval in Checklists and Startup.

1. The Contractor shall clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxA within two days of test completion.

2. The Commissioning Agent will review the report and submit comments to the CM. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the CM and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner and shall notify the PM/CM and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the PM/CM.

3. The Contractor shall be responsible for resolution of deficiencies as directed the PM/CM.

3.3 TEST AND BALANCE VERIFICATION

A. Objective & Scope: The objective of TAB verification is to verify that air and water testing and balancing has been completed and all issues have been resolved prior to functional performance testing. A TAB report is required to be submitted to the CxA for review prior to scheduling verification. The CxA and the TAB contractor will meet on-site to discuss the
report and walk the building to verify 20% of the total amount tested using a random sample, utilizing the same equipment that was used to perform the test and balance. Any portions that fail the testing require an additional test. Acceptable results include those that are within specified tolerance of the design values (5-10%). If more than 20% fail the testing, the report is rejected, and additional balancing must be completed, and a revised report submitted before this portion of functional testing is considered complete.

3.4 DDC SYSTEM TRENDING FOR COMMISSIONING

A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.

B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers – Critical, Priority, and Maintenance.

1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit’s graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.

2. Priority level alarms are to be printed to a printer which is connected to the Operator’s Workstation located within the engineer’s office. Additionally, Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.

3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer’s office.

C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.

D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:

1. Pre-testing, Testing, and Post-testing – Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the CxA. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the PM/CM, prior to the execution of Systems Functional Performance Testing.
2. Dynamic plotting – The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.

3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct Digital Control System, then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.

4. The points to be trended are identified in the Functional Test Checklist by equipment.

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified after submission shall be recorded and resubmitted to the CM and Commissioning Agent.

1. Point-to-Point checkout documentation;
2. Sensor field calibration documentation including system name, sensor/point name, measured value, DDC value, and Correction Factor.
3. A sensor calibration table listing the referencing the location of procedures to following in the O&M manuals, and the frequency at which calibration should be performed for all sensors, separated by system, subsystem, and type. The calibration requirements shall be submitted both in the O&M manuals and separately in a standalone document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Calibration Frequency</th>
<th>O&amp;M Calibration Procedure Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge air temperature</td>
<td>Once a year</td>
<td>Volume I Section D.3.aa</td>
</tr>
<tr>
<td>Discharge static pressure</td>
<td>Every 6 months</td>
<td>Volume II Section A.1.c</td>
</tr>
</tbody>
</table>

4. Loop tuning documentation and constants for each loop of the building systems. The documentation shall be submitted in outline or table separated by system, control type (e.g. heating valve temperature control); proportional, integral and derivative constants, interval (and bias if used) for each loop. The following table is a sample that can be used as a template for submission.

<table>
<thead>
<tr>
<th>AIR HANDLING UNIT AHU-8</th>
<th>Proportional Constant</th>
<th>Integral Constant</th>
<th>Derivative Constant</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating Valve Output</td>
<td>1000</td>
<td>20</td>
<td>10</td>
<td>2 sec.</td>
</tr>
</tbody>
</table>

3.5 FUNCTIONAL PERFORMANCE TESTING
A. Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the Contract Documents. Each system will be tested to verify that the system response is as designed. Commissioned systems will be
checked for conformance to the design sequences of operation and stable control. Proper system responses to such conditions as power failure, out of limit condition, equipment failure, etc. shall also be tested.

B. Development of Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The test procedures are written by the CxA based upon the final operational sequences from available project documentation. The CxA shall develop specific test procedures and forms to verify and document proper operation of each system. Prior to execution, the CxA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, equipment and warranty protection. The test procedure checklists developed by the CxA shall include the following information:

1. System and equipment or component name(s).
2. Equipment location and ID number.
3. Date.
4. Project name.
5. Participating parties.
6. Reference to the specification section describing the test requirements, if applicable.
7. Identification of control points
8. Identification of specific control points to be trended as part of the testing
9. A summary of the specific sequence of operations.
10. Prerequisites for the test.
11. Special cautions, alarm limits, etc.
13. Acceptance criteria of proper performance with a Yes / No/NA check box.
14. A section for comments.

C. Test Methods.

1. Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system’s trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.

   a. **Simulated Conditions:** Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.

   b. **Overwritten Values:** Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

   c. **Simulated Signals:** Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
d. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.

e. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.

D. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.

E. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The sampling rate is specified in Section 3.01. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.

F. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

G. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the PM/CM regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and CM. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.

H. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the PM/CM before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting, individual systems has been achieved, the interface or coordinated responses between systems will be checked.

I. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

3.6 Common Elements for All Systems

A. Have the required submitted documentation convenient to testing area. Validate that all required documentation has been submitted and is per the contract requirements (very cursory review). CxA shall review the content of the documentation and validate that it is per contract documents.
B. CxA shall review the startup documentation at the start of functional performance testing. Review the startup tests and checklist documentation. CxA shall validate that startup is acceptably executed and complete. CxA shall ensure that any items indicated as outstanding in the checklists is entered as an Action Item and enter one if it is not. The checklists and start up tests/measurements shall be spot checked at the beginning of FPT to ensure accuracy. CxA shall complete a test that indicates he has reviewed the prefunctional checklists and finds them acceptable and note any outstanding items.

C. CxA shall check for and as applicable direct Contractor to demonstrate that access is sufficient to perform required maintenance.

D. CxA shall validate that all prerequisite work is complete and confirm via a test record that he feels it is.

E. Specifically check labeling and ensure conformance to contract requirements.

F. Check proof indication, alarming on failure and restart/acknowledgement as applicable.

G. CxA shall observe operating conditions encountered at the start of FPT. CxA shall examine for normal functionality and record parameters as a test.

H. All dynamic systems powered by electricity shall be tested to simulate a power outage to ensure proper sequencing. Those on emergency power or uninterruptible power shall be tested on all sources.

I. CxA shall inspect the installation and compare it to contract requirements. Record the inspection as a test.

J. Capacities and adjusted and balanced conditions as applicable will generally be checked.

K. Verify all sequence modes and sequences of operation. CxA must initiate all modes and may not refer to or rely on a prefunctional test done by the BAS. Some examples of generic modes that apply to most systems include:

1. Off Mode
2. Failed Mode: Proof, safeties, power outage etc. See below for crash testing.
3. Start Sequence in various modes
4. Stop sequences in various modes

L. All adjusted, balanced, controlled systems shall be assessed to determine the optimal setting for the system as applicable. The optimal settings should be determined to establish reliable, efficient, safe and stable operation. CxA is responsible for placing systems in optimal condition for occupancy and not simply relying on initial design estimated settings.

M. Dynamic Graphics: The graphic for all components, systems, and areas sampled and required to be represented by a graphic shall be checked for adequacy and accuracy. Furthermore, when setpoints are required to be adjustable, verify that they can be adjusted directly from the graphic screen.

N. All interfaces between two systems or equipment of different manufacturers must be checked for accuracy and functionality.

O. CxA shall to the extent possible, load the heating and cooling systems during initial FPT to check the capacity of the building central systems and initially optimize system settings. This will typically be done using the preheat system to false load the cooling system. This test will incorporate varying the load to check central systems response.

P. “Crash Testing”: CxA shall analyze systems to identify possible conditions where functionality may be compromised. CxA shall design non-destructive tests that will demonstrate either the automated response to the conditions or so that team can identify the best method for responding or fixing the condition. All tests and finding shall be documented.

Q. Building Enclosure Systems Functional Performance Testing

1. Participants shall include CxA, GC and water-proofing subcontractors
2. Sample 50%; failure 0%
3. CxA shall review construction checklists and perform site inspections during installation to verify completeness per specification.
4. The CxA may witness testing performed by contractor and will review all test reports.

5. **Foundation:** Upon completion of the under-slab vapor retarder installation the contractor will perform a field inspection to ensure that the installation was performed in accordance with manufacturer’s instructions, construction documents, ASTM E1745-11 and ASTM E1643-11. CxA will observe and inspect the installation of the under-slab vapor retarders.

6. **Walls:**
   a. Upon completion of the wall insulation installation and prior to installation of wall sheathing, e.g. gypsum board, the contractor will field verify to ensure that the insulation installation was performed in accordance with the construction documents.
   b. After wall sheathing installation and in accordance with ASTM C 1060-90, Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Framed Buildings the CxA will perform a thermographic insulation inspection. A FLIR Systems B20 thermal imaging camera will be used to perform the imaging. Up to 20% of the insulation within envelope cavities will be inspected for thermal anomalies. The contractor will be responsible to correct any identified anomalies.

7. **Windows:** Upon completion of exterior windows and prior to installation of insulation and wall sheathing the contractor will perform a field water spray test to 20% of the exterior windows. Using a hand-held spray assemble employing a Type B2 #6.030 nozzle, pressure gauge, control valve and a ¾” garden hose apply water to the windows at 30 psi. Direct the water at joints and perpendicular to the face of the window frame. Slowly move the nozzle back and forth above the window joints at a distance of 1'-0" for a period of five minutes for each 5'-0" of joint. At the same time have an observer on the inside of the building to check for water leakage. The contractor will be responsible to repair any identified leaks and retest repaired joints.

8. **Doors -** The contractor will perform visual inspections of all exterior doors with weather-stripping. The contractor will be responsible to adjust doors for proper operation and weather seal. CxA will inspect, test or operate a random sampling of exterior doors to verify proper seal.

9. **Roof -** Contractor shall perform infrared roof survey in addition to the water test outlined in Section 07 54 00-13 of the specifications. The infrared roof survey will be performed in accordance with ASTM C 1153 – Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging. Perform the infrared roof survey shortly after sunset when the surface temperature of the roof drops quickly. Water contained in the roof system or insulation cool slower due to water having a higher specific heat capacity than roof membranes and other building products. Contractor will identify thermal anomalies by using a FLIR Systems B20 thermal imaging camera. Mark any identified anomalies on the roof surface for evaluation and repair.

R. **Domestic Water Systems Functional Performance Testing**

1. Participants shall include CxA, PC
2. Sample 100% of equipment and 50% of fixtures; failure 10%
3. CxA shall review prefunctional checklists, chlorination report and any factory start-up reports to verify prefunctional testing is completed.
4. Contractor to demonstrate settings and sequences of water heater, circulation pump, temperature mixing valves and controls.
5. Domestic hot water will be tested by the CxA by measuring the hot water temperature at all fixtures along with the time it takes to reach that temperature.
6. Plumbing fixtures will be checked for proper operation and water saving features.
S. HVAC System Pumps Functional Performance Test

1. Participants shall include CxA, MC, TAB, and BAS (where pumps are automatically controlled).

2. Sample 100%

3. CxA shall review prefunctional checklists, start-up reports, and TAB report.

4. CxA shall blow off strainers to validate that they are clean.

5. Pumps shall be manually started individually. Pressure differential, KW (or slip on the motor), and flow shall be checked at shut-off, wide open, and balanced (or controlled) condition. Generally, the reading from the instrumentation provided with the pump (thermometers and pressure gages and flow meters as applicable) will be acceptable if used to validate an action as opposed to checking balancing. Listen to pump to ensure no excessive noise or vibration

6. For pumps designed with automatic starting of back up pump on primary pump failure:
   a. Enable automatic controls.
   b. Start primary pump.
   c. Throw disconnect switch of primary pump, and validate that standby is energized. Perform this test on all pumps.
   d. Change lead and retest.

7. Check proof indication and alarm. Generally, affect failure by turning off electrical feed at each available dedicated location (i.e.: breaker feeding drive or starter (when dedicated), throwing disconnect on starter or drive and/or turning HOA to off, and disconnecting local motor disconnect (coordinate with drive manufacturer where applicable particularly when reconnecting).

8. For staged pumping systems:
   a. Vary load by opening and closing valves to affect a stage up and stage down.
   b. Fail pumps throughout the process to ensure staging logic responds correctly.
   c. Ensure minimum run and off times of stages. Consider criticality of the system.
   d. Change pump priority and perform the same process with another priority.

9. For multiple pump systems, affect or observe a normal rotation of lead or priority sequence.

10. Simulate peak and minimum operating pressure conditions on the systems and check stroke and ranges on valves to ensure adequate close off and ranging.

11. For variable speed pumps:
   a. Manipulate control valves to change flow conditions (increase and decrease) and observe control response.
   b. Ensure stable control response to step change in flow conditions in both directions.
   c. Check for the applicable acceleration and deceleration of the pumps.
   d. Spot check for critical frequencies by manually ramping pump speed from min. to max. to ensure stable operation of pumps and record/defeat any critical frequencies.
   e. Record representative part load output from the drive (using VFD read out).
   f. Check calibration of control input. Check drive bypass operation if applicable.
   g. Specifically check for status indication at minimum pump speed and ensure reliability of status signal

12. Simulate power outage and ensure orderly and automatic restart.
T. Rooftop Package AC Unit Functional Performance Test

1. Participants shall include CxA, MC, TAB, and BAS.
2. Sample 100%
3. CxA shall review prefunctional checklists, start-up check-lists and TAB reports.
4. Verify automatic start/stop of fan and open/close of outdoor air damper.
5. Start heating and cooling system, manipulate control device to obtain maximum cooling and heating. Measure temperatures and pressures to determine capacity.
6. Weather permitting cause all applicable modes of operation using false loading where practical. Check proper sequence for switching modes and proper operation within a mode.
7. Check calibration of control devices and for stable control response and component performance including chilled water coils, hot water coils, steam coils, humidifiers, economizer cycles, etc. Ensure proper coordination of control loops and that no fighting or energy wastes result.
8. Check for free and adequate flow of AC condensate.
9. Spot check valve close off under peak pressure conditions that the valve will try to close.
10. For variable speed fans:
   a. Manipulate air terminal units to change flow conditions and observe control response. Ensure stable control response to step change in flow conditions.
   b. Manually ramp fan speed from min. to max. to ensure stable operation of fans.
   c. Record representative part load output from the drive.
   d. Check calibration of control inputs.
   e. Check drive bypass operation if applicable.
11. For fans with inlet vanes:
   a. Manipulate air terminal units to change flow conditions and observe control response. Ensure stable control response to step change in flow conditions.
   b. Manually modulate vanes from min. to max. to ensure stable operation of fans.
   c. Record representative part load power draw on the motor.
   d. Check calibration of control input.
12. Ensure minimum required ventilation rates are maintained across the full range of control where applicable.
13. Test all interfaces with the fire alarm system and all smoke control sequences.
14. Verify interlocks with exhaust fans where applicable.
15. Test proof alarming where applicable.
16. Test operation of applicable safeties including freeze stats, high and low static devices, smoke detection, etc. Check AH component status in each event.
17. Check system status and operation in the Off, Unoccupied, and Occupied Mode of operation. Validate proper start up and shut down sequences.
18. Simulate power outage, operation under emergency power where applicable, and ensure automatic and orderly restart.
19. Where systems are headered and/or sequenced, vary loading to affect stage up and stage down. Adjust parameters to affect smooth staging. Validate that header pressure is not compromised in the event of a failure of one of the units.
20. Check temperature sensor coordination by isolating or stopping coils and heat wheels with air flowing.
U. Exhaust Fan/Air System Functional Performance Test.

1. Participants shall include CxA, MC, TAB, and BAS.
2. Sample 20%
3. CxA shall review prefunctional check-lists, start-up reports and TAB reports.
4. Verify start/stop control sequences.
5. Check the capacity of the fan at maximum conditions.
6. Cause all applicable modes of operation using false loading where practical.
   Check proper sequence for switching modes and proper operation within a mode.
7. For variable speed fans:
   a. Manipulate air terminal units to change flow conditions and observe control response. Ensure stable control response to step change in flow conditions.
   b. Manually ramp fan speed from min. to max. to ensure stable operation of fans. Record representative part load output from the drive.
   c. Check calibration of control input.
   d. Check drive bypass operation if applicable.
8. For fans with inlet vanes:
   a. Manipulate air terminal units to change flow conditions and observe control response. Ensure stable control response to step change in flow conditions.
   b. Manually modulate vanes from min. to max. to ensure stable operation of fans. Record representative part load power draw on the motor.
   c. Check calibration of control input.
9. Verify interlocks with AC units, thermostats etc. where applicable.
10. Test all interfaces with the fire alarm system and all smoke control sequences.
11. Test proof alarming where applicable. Simulate failures of fans and ensure proper start-up of back up fans. Check status indication at minimum fan speed to ensure reliable and repeatable condition.
12. Test operation of applicable safeties including freeze stats, high and low static devices, smoke detection, etc.
13. Check system status and operation in the Off, Unoccupied, and Occupied Mode of operation. Validate proper start up and shut down sequences.
14. Simulate power outage, operation under emergency power where applicable, and ensure automatic and orderly restart.
15. Where systems are headered and/or sequenced, vary loading to affect stage up and stage down. Adjust parameters to affect smooth staging. Validate that header pressure is not compromised in the event of a failure of one of the units.

V. HVAC VAV Air Terminal Functional Performance Test

1. Participants shall include CxA, MC, TAB, and BAS.
2. Sample 20%, max failure limit 10%
3. CxA shall review start-up check-lists and TAB reports.
4. Check the calibration of zone temperature sensors.
5. Set boxes for both minimum and maximum flow (typically by setting the space temperature setpoint up and down) and check the calibration of the flow settings
6. Check the stability of the zone temperature control loop for the damper and any associated heating devices by changing the space setpoints and observing the response.
7. Cause all applicable modes of operation using false loading where practical.
   Check proper sequence for switching modes and proper operation within a mode.
8. Determine the optimal settings for the control parameters
9. Simulate and test the unoccupied and emergency mode response of the box where applicable
10. Check the capacity of the heating device where applicable
W. Building Automation System Functional Performance Test

1. Participants shall include C x A, MC, and BAS.

2. Controls system sampling will typically correspond to the sampling rate of a system or piece of equipment. These sampling rates are indicated in Section 3.01 for the respective item.

3. Contractor shall operate the equipment and subsystems through all specified modes of control and sequences of operation including full and part load conditions, and emergency conditions.

4. Verify that equipment operates in accordance with design intent and approved control diagrams. This shall include checking the operation of dampers, valves, smoke detectors; high and low limit controls, of a sample of 25% of components with a maximum failure limit of 10%.

5. Analog Input Sensors: (at a sample of 50% of the inputs on the sampled devices (see above for device samples) with a maximum failure rate of 10%) Spot check analog input sensors (space temperature sensors, outside, return, and mixed air temperature sensors, discharge air temperature sensors, chilled water and hot water temperature sensors, and humidity sensors, air and water differential pressure sensors, airflow monitoring stations, etc.) for acceptable accuracy (which is generally as specified for the device).

6. Valves, Dampers and Actuators: (at a sample of 50% of the inputs on the sampled devices (see above for device samples) with a maximum failure rate of 10%) Ensure that valves and dampers and their actuators close off or seal against the maximum pressure differential. Ensure that the actuators stroke throughout the correct range and that the positioners are set correctly where applicable.

7. Analyze trends of control system points for a minimum of a one-week period prior to and throughout the Acceptance period. Trends shall be analyzed to identify any control problems, lack of capacity, control loops fighting or unstable, etc.

8. Spot (at a sample of 50% of the inputs on the sampled devices (see above for device samples) with a maximum failure rate of 10%) check the operation of all automatic switches (pressure switches, current switches, flow switches, etc.) to ensure that they are adjusted to proper make and break settings.

9. Verify the stand-alone functionality of the controllers. Generally, disconnect LAN communication wiring and ensure that the controller functions properly and that the loss of communication is acknowledged by the interface. Restore communications and ensure an orderly restoration to normal control.

10. Verify that the EMS interface, EMS software, graphics and functions are in accordance with design intent and approved control diagrams.
   a. Validate intuitive interface and graphic linking.
   b. Validate all graphics are done and accurate.
   c. Validate that all graphics contain required information.
d. Validate that all security passwords and access to system information has been set up correctly.

e. Validate that point naming convention is consistent and per Owner requirements.

11. Check dial in communications and pager functions where applicable to ensure functionality.

12. Energy Meters shall be checked for proper calibration and an energy dashboard setup to graphically represent the energy demand and use over time. Energy meters shall be trended per the CxA and District sampling rates and conform to section 25000, 3.10 Color Graphics, A.10. Energy Screen.

X. Lighting Fixtures and Lighting Controls Functional Performance Testing

1. General: Provide the services of a factory trained manufacturer's representative to assist the contractor in the installation and start up service of the lighting control system and train Owner's maintenance personnel as specified below. Representative will confirm the proper installation and operation of all system components.

2. Start-up checklists: Perform the following final checks before startup:

   a. Ensure all labeling is affixed and accurate
   b. Ensure all terminations are tight.
   c. Check sensor placement is adequate for required duty.
   d. Ensure adequate access is provided to all panels and that documentation of that panel is provided in it.
   e. Ensure all circuits for the loads are energized and ready for testing.

3. Starting Procedures: Follow the manufacturer's written procedures and the following as a minimum:

   a. Test, calibrate, and set all digital and analog sensing, and actuating devices. Calibrate each instrumentation device by making a comparison between the graphic display and the reading at the device, using an instrument traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be calibrated (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range). Record the measured value and displayed value for each device in the Start-Up Report.
   b. Check each digital control point by making a comparison between the control command at the control panel and the status of the controlled device. Check each digital input point by making a comparison of the state of the sensing device and the OI display. Record the results for each device in the Start-Up Report.
   c. Check loads on all breakers to ensure that the breaker is properly sized.
   d. Enter all schedules per occupant's direction.

4. For Operator Interfaces:

   a. Verify all elements on the graphics are functional and properly bound to physical devices and/or virtual points and that hot links or page jumps are functional and logical.
   b. Output all specified reports for review and approval.
   c. Verify the alarm printing and logging is functional and per requirements
   d. Validate all interfaces with other systems on a point by point basis

5. Daylighting and Dimming Controls:

   a. Participants shall include CxA, EC and trained manufacturer's representative.
   b. Sample 50%
c. CxA shall review prefunctional check-lists and factory start-up reports.

d. Verify daylighting and dimming control sequences and setpoints for photocells for required foot-candle levels at desk level (30" above finish floor).

e. Check proper sequence for low voltage switch modes and proper operation within a mode.

6. Occupancy Sensors

a. Participants shall include CxA and EC.

b. Sample 20%

c. CxA shall review prefunctional check-lists.

d. Verify occupancy sensors are set for proper sequence of operation and set per approved Owner requirements including coverage, sensitivity and time delay.

Y. Landscape Irrigation Functional Performance Test

1. Participants shall include CxA and Landscape Contractor.

2. Sample: All irrigation controllers, 20% (of zones coverage test using thermographic camera for bubblers), max failure limit 0%.

3. Check irrigation controller schedule and zone settings and record to verify conformance with approved schedules and settings.

4. CxA shall review as-built drawings, pressure test documentation for drip emitters and inline drip tubing and confirm valves have been adjusted, heads aligned, and coverage has been adjusted for each zone.

3.7 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS

A. Documentation: The Commissioning Agent will witness and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the PM/CM and the CxC for review and approval. The Contractor shall include the filled-out forms with the O&M manual data.

B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the CM/CxC on Commissioning Field Reports and/or the Commissioning Master Issues Log.

1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.

2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the PM/CM.

3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.

4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:

   a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will
submit a Commissioning Field Report to the PM/CM. The Commissioning Agent will also note items of noncompliance and the Contractor’s response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the CM and the Commissioning Agent.

b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.

5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:

a. The item of noncompliance shall be documented on the test form with the Contractor’s response. The item of noncompliance with the Contractor’s response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.

b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the PM/CM.

c. The Commissioning Agent will document the resolution process.

d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.

C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the PM/CM. In such case, the Contractor shall provide the PM/CM with the following:

1. Within one week of notification from the PM/CM, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the PM/CM within two weeks of the original notice.

2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

3. The PM/CM shall determine whether a replacement of all identical units or a repair is acceptable.

4. Two examples of the proposed solution shall be installed by the Contractor and the PM/CM shall be allowed to test the installations for up to one week, upon which the PM/CM will decide whether to accept the solution.

5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be
made later after review by the Commissioning Agent and by the PM/CM. The Commissioning Agent will evaluate each test and report to the PM/CM using a standard form. The PM/CM will give final approval on each test using the same form and provide signed copies to the Commissioning Agent and the Contractor.

3.8 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, CxA shall convene a training preparation conference to include Owner's operation and maintenance personnel, Contractor, and subcontractors. Perform the following:

1. Review installed systems, subsystems, and equipment.
2. Review instructor qualifications.
3. Review instructional methods and procedures.
4. Review training module outlines and contents to ensure it meets the specific maintenance personnel requirements.
5. Review course materials (including operation and maintenance manuals).
6. Inspect and discuss locations and other facilities required for instruction.
7. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
8. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable

B. Training of Owner Personnel

1. Provide the CxA with training agendas and schedule at least two weeks before the planned training.
2. Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned electrical equipment or system.
3. Training shall start with classroom sessions, if necessary, followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including start-up, shutdown, fire/smoke alarm, power failure, etc.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment is required. More than one party may be required to execute the training.
6. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
7. Training shall include:
   a. Use the printed installation, operation and maintenance instruction material included in the O&M manuals.
   b. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
   c. Discuss relevant health and safety issues and concerns.
   d. Discuss warranties and guarantees.
   e. Cover common troubleshooting problems and solutions.
f. Explain information included in the O&M manuals and the location of all plans and manuals in the facility.
g. Discuss any peculiarities of equipment installation or operation.
h. Classroom sessions shall include the use of overhead projections, slides, video and audio taped material as might be appropriate.

8. Hands-on training shall include start-up, operation in all modes possible, including manual, shutdown and any emergency procedures and maintenance of all pieces of equipment.

9. Training shall occur after functional testing is complete, unless approved otherwise by the PM/CM.

10. All training shall be videotaped per spec section 01820, Demonstration and Training.

C. BAS Demonstration and Orientation

1. The intent of the demonstration and orientation is to provide the Owner, Testing Contractor, and Commissioning Authority with a reasonable level of assurance that the system is complete and ready for functional performance testing, and to provide an initial orientation to the system configuration, set-up, features, and commissioning related procedures.

2. Demonstrate the operation of a sampling of the BAS hardware, software, and all related components and systems to the satisfaction of the CxA. Schedule the demonstration with the Owner's representative 2 weeks in advance. Demonstration shall not be scheduled until all hardware and software submittals, and the Pre-functional Test Reports are approved. If in the judgment of the CxA the Work fails to be demonstrated to be complete and ready for functional testing, so as to require additional site visits by the CxA for re-demonstration, Contractor shall reimburse Owner for all costs of subsequent CxA site visits for demonstration.

3. The Contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, etc. Contractor supplied personnel shall be competent with and knowledgeable of all project-specific hardware, software, and the HVAC systems. All documentation and submittals shall be at the job site.

4. The system shall be demonstrated following the same procedures used in the Pre-functional Test. Demonstration shall include, but not necessarily be limited to, the following:

   a. Demonstrate that all required software is installed on workstations. Demonstrate that all graphic screens, alarms, trends, and reports are installed as submitted and approved.
   b. Demonstrate that a sampling of points specified and shown can be interrogated and/or commanded (as applicable) from all workstations, as specified.
   c. Demonstrate that remote dial-up communication abilities (as applicable) are in accordance with contract requirements.
   d. Demonstrate correct calibration and calibration procedure for a sampling of input/output devices selected by the Owner and CxA.
   e. Demonstrate that all DDC and other software programs exist at respective field panels. The Direct Digital Control (DDC) programming and point database shall be as submitted and approved.
   f. Demonstrate that all DDC programs accomplish the specified sequences of operation.
   g. Demonstrate that the panels automatically recover from power failures, as specified.
   h. Demonstrate that the stand-alone operation of panels meets the requirements of these Specifications. Demonstrate that the panels'
response to LAN communication failures meets the requirements of these Specifications.

5. Failure of any of the above items shall be noted as part of the functional testing, and failed items shall be corrected to conform to contract requirements.

6. BAS Demonstration shall be completed prior to functional performance testing and Substantial Completion.

3.9 Performance Period

A. Upon successful completion of functional acceptance tests, a performance period of 7 consecutive calendar days shall commence on first day following the last acceptance test. This period shall be completed prior to final acceptance of the project. In event of failure to meet standard of performance during any initiated performance period, it is not required that one 7-calendar day period expire in order for another performance period to begin.

B. If equipment or system operate and demonstrate continuing compliance with specified requirements for period of 7 consecutive calendar days from commencement date of performance period, it shall be deemed to have met the standard of performance.

C. Equipment will not be accepted by the Owner and final payment will not be made by the Owner until acceptable performance is met.

D. Contractor shall provide Commissioning Authority with trend logs of the system performance for the control variables and set point in each control process in 15-minute time intervals.

E. Systems shall be first tested as independent building systems followed by tests of systems tied into Owner’s systems. Types of Owner’s systems include, but are not limited to, central plant heating and cooling; off-site security / alarm monitoring; and campus automated controls systems.

F. Upon Contractor’s completion of the requirements of the commissioning plan and the successful completion of the performance period, and receipt of the required documentation, the Commissioning Authority shall provide the Owner with a statement of acceptable performance.

G. Trend Logs

1. Trend logs are databases of ASCII characters (usually numbers) representing a historical record of the systems operation. Contractor shall establish and store these trend logs.

2. Trend logs shall be set up for all control system points on an average of 15-minute intervals or change of value thresholds as approved by CxA. BAS contractor must design panel and network loading to accommodate this trending without adversely impacting the control system functionality.

3. CxA will analyze trend logs of the system operating parameters to evaluate normal system functionality. Contractor shall establish these trends, ensure they are being stored properly, and forward the data in electronic format to the CxA.

4. Data shall include a single row of field headings and the data thereafter shall be contiguous. Each record shall include a date and time field. Recorded parameters for a given piece of equipment or component shall be trended at the same intervals and be presented in a maximum of two separate two dimensional formats with time being the vertical axis and field name being the horizontal axis. Data shall be forwarded in one of the following formats.

   a. Microsoft EXCEL Spreadsheet (.xls)
   b. Comma Separated Value (.csv or .txt) preferably with quotes delimiting text fields and # delimiting date/time fields

5. If sample times are trended as COV or change of value, when output to the trending file, the latest recorded value shall be listed with any given time increment record. If the system does not have the capability to fill the archive with
the latest value, the parameter shall be recorded based on the interval common to
the unit.

6. Contractor shall provide the CxA with required passwords, phone numbers, etc. to
allow the CxA access to the trend log data and allow downloading to a remote
location. Contractor shall also provide step-by-step written instructions for
accessing the data.

3.10 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the project
completion level, required occupancy condition or other deficiency, execution of checklists
and performance testing may be delayed upon approval of the CxA. These tests will be
conducted in the same manner as the seasonal testing as soon as possible. Services of
necessary parties will be negotiated.

B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until
weather conditions are closer to the system’s design) shall be completed as part of this
contract. The testing will include the use of BAS trend reports provided by the contractor,
setup during the construction phase, to assist in evaluating the performance during the
opposite season with the outdoor conditions as close to the design as possible. The CxA
shall coordinate this activity through the Owner/CM. Tests will be executed,
documented by the CxA and deficiencies should be corrected by the appropriate
contractor/ subcontractors with the CxA witnessing. Any final adjustments to the O&M
manuals and as-built drawings due to the testing shall be made by the contractor.

3.11 Warranty Review

A. During the first year of the system and buildings’ operation, it is important to assure that
the performance of the facility is maintained, particular before the warranty period expires.
At 10 months into a 12-month warranty period, operation of system and components is
reviewed by the Owner, Contractor, and the CxA to identify any items that must be
repaired or replaced under warranty. CxA will also interview building operating personnel
to identify any outstanding warranty failures and any persistent equipment failures that
should be handled within the warranty period. This review is based on warranty items and
continued performance with Owner’s project Requirements. The CxA will document the
results and forwards recommendations to Owner and Contractor for resolution.

END OF SECTION 01810 / 01 91 13
BID DOCUMENTS COVER SHEET

CONTRACT DOCUMENTS

FOR

D-4002 DVC San Ramon Campus

INCREMENT 2 – EXPANSION & RENOVATION

AT

DIABLO VALLEY COLLEGE
SAN RAMON CAMPUS
1690 Watermill Rd.
San Ramon, CA 94582

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

Consist of the following:
DSA Application #01-117630

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Architect: Noll & Tam
729 Heinz Ave. #7
Berkeley, CA 94710
(510) 542-2200

May 30, 2019
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PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes all work necessary to successfully complete demolition to prepare site for the phasing and new construction, including the following:

1. Clean line saw cutting of existing asphalt pavement, concrete sidewalks, concrete curb/gutter, etc., as specified herein.
2. Protection from injury or defacement existing building elements to be preserved.
3. Removal of debris and deleterious materials such as rubbish.
4. Removal and stockpile of materials for landscaping use at approved location.
5. Disposal of unwanted or objectionable materials off site.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Disconnecting, capping or sealing, and removing site utilities.
8. Removing above-grade site improvements within limits indicated.

1.2 REGULATORY REQUIREMENTS:

A. No burning shall be allowed.
B. Do not use explosives.
C. Comply with the following California Code of Regulations:
   1. Title 8: CAL/OSHA, Chapter, Subchapter 4 – Construction Safety Orders.
   2. Title 24: Part 2, California Building Code, Chapter 33, Protection of Pedestrian during Construction or Demolition.
   3. Sacramento Metropolitan Air Quality Management District.
D. Owner’s requirements

1.3 DEFINITIONS

B. CAL-OSHA: California Occupational Safety and Health Administration.
E. EPA: Environmental Protection Agency.

G. Remove: Detach items from existing construction and legally dispose of them off-site unless they indicated to be removed and salvaged or recycled.

H. Remove and Salvage: Detach items from existing construction, prior to demolition, and deliver them to the Equipment yard adjacent to Central Plant or to District designated location. Coordinate with District.

I. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or recycled.

1.4 SUBMITTALS

A. Follow Submittal procedure outlined in Division 1– General Requirements.

1.5 PROJECT CONDITIONS

A. In all circumstances ensure that demolition work does not adversely affect adjacent water courses groundwater and wildlife, or contribute to excess air and noise pollution.

B. Do not dispose, of waste or volatile materials such as mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.

C. Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.

D. Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.

E. Protect trees, plants and foliage on site and adjacent properties where indicated.

F. Except for materials indicated to be stockpiled or to remain, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to structural backfill defined in Section 31 23 33 Trenching and Backfilling.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points during construction.
B. Protect existing site improvements to remain during construction.

C. Provide the following temporary facilities to facilitate the demolition operations, as necessary:
   1. Temp Traffic Controls
   2. Protection of Persons and Property
   3. Protection of Utilities
   4. Protection of Trees
   5. Noise and Dust Abatement
   6. Clear and restore area to their original condition
   7. Protect existing site improvements and adjacent structures from removal and damage.
   8. Protect and maintain benchmarks and survey control points during construction.

3.2 RESTORATION

A. Restore areas and existing works outside areas of demolition to match conditions to their original condition, as acceptable to the District.

B. Restore damaged improvements to their original condition, as acceptable to the District.

3.3 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.

B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by District or others unless authorized in writing by the District and then only after arranging to provide temporary utility services according to requirements indicated.

D. Coordinate utility interruptions with utility company affected.

E. Do not proceed with utility interruptions without the permission of the District and utility company affected. Notify the District and the utility company affected 14 working days prior to utility interruptions.

F. Excavate and remove underground utilities that are indicated to be removed.

G. Securely close ends of abandoned piping with tight fitting plug or wall of concrete minimum 6-inches thick.

H. Adjustment of manhole frames and other castings Sacramento Standard Specifications.
3.4 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.

C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark or edge, remove material to joint, mark or edge.

3.5 SALVAGED IMPROVEMENTS

A. Salvaged Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the District. Avoid damaging materials designated for salvage.

3.6 DISPOSAL

A. Remove surplus obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the District’s property.

B. Remove: Unless items are otherwise to remain or be reinstalled, remove and dispose of items. Do not store removed items that is of value to the contractor on site.

C. Remove and Reinstall: Remove items; clean, service and otherwise prepare for service; reinstall in the same location (or in the location indicated by the District).

D. Unidentified Materials: If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the District. If necessary, the District will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

3.7 CONSTRUCTION WASTE MANAGEMENT

A. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the General Contractor’s Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Selective demolition of building elements.
   1. Protect items in place as indicated on the Drawings.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the District’s property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the District’s property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to the District’s designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

E. Materials Ownership: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the District’s property, demolished materials shall become the Contractor’s property and shall be removed from the site with further disposition at the Contractor’s option.

1.3 SUBMITTALS

A. Schedule of selective demolition activities indicating the following:
   1. Interruption of utility services and security devices.
   2. Coordination for shutoff, capping, and continuation of utility services and security devices.
   3. Removal and/or relocation of components and systems indicated on the Drawings and as required for new work as shown.

B. Work Description: Submit proposed methods and operations of protection of existing finishes to the Architect and District for review and approval prior to the commencement of work. Mockups may be required.
   1. Submit a complete set of shop drawings indicating the protection methods and materials. Include attachment and support details and all required dimensions.
Include proposed method of protecting construction previously not exposed to the elements from adverse weather conditions until the building is weather tight.

2. Include an inventory of items to be removed and salvaged.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

D. Record drawings at Project closeout identifying and accurately locating capped utilities and other subsurface structural, electrical, plumbing, mechanical, and security devices.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. The Contractor is hereby directed to recognize the value and significance of the building, and exercise special care during all phases of the work to ensure that the existing building, its details, materials and finishes that are to remain or to be salvaged for the intention of reinstallation are not damaged by the work being performed.

   1. The Contractor shall be responsible for the actions of his/her personnel and of the Contractor’s subcontractors.

1.5 PROJECT CONDITIONS

A. Conditions existing at time of inspection for bidding purposes will be maintained by the District as far as practical.

B. Coordinate the performance of work in this Section with related or adjacent work.

C. Protection of items should be completed prior to commencement of new construction and demolition procedures. At the end of working day or during inclement weather, cover work exposed to weather with waterproof coverings, securely anchored.

D. Hazardous materials are not expected to be encountered in the Work. If any materials suspected of containing asbestos or lead are encountered, do not disturb the materials. Immediately notify the Architect and the District’s Project Manager.

E. Provide minimum 72 hours notification for any shutdown or isolation requests that will impact General Conditions of the Contract or work restrictions.

PART 2 - PRODUCTS

2.1 PROTECTION MATERIALS

A. Polyethylene Sheets: 4 mil.

B. Lumber: Species to be selected by the Contractor, with sizes to fit field conditions. Lumber shall be fire retardant treated.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that affected utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
   1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
   2. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

C. When unanticipated plumbing, mechanical, electrical, security, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

D. Survey the condition of the buildings to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structures during selective demolition.

E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. General
   1. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   2. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized by the District’s Project Manager.
3. Provide minimum 72 hours notification for any shutdown or isolation requests when authorized by the District’s Project Manager.
4. Provide temporary services during interruptions to existing utilities, as acceptable to the District’s Project Manager and to governing authorities.

B. Conform to the District’s specific procedures relating to utility services where utility services are required to be removed, relocated, or abandoned during selective building demolition.

3.3 PREPARATION

A. Conduct demolition operations and remove debris to ensure minimum interference with streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the District’s Project Manager and authorities having jurisdiction.

B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.
   1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
   2. Protect existing site improvements, appurtenances, and landscaping to remain.
   3. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces to ensure that no water leakage or damage occurs to structure or interior areas.
   4. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.

C. Provide and maintain interior and exterior bracing or structural support to preserve stability and prevent movement, settlement, or collapse of portions of building to be selectively demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C. Clean adjacent site areas of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.5 INSTALLATION OF PROTECTION

A. General
   1. Alternative methods to specified protection may be acceptable if equal or greater protection is provided. Submit alternative methods to the Architect for review as
specified. Do not proceed with alternative methods until specified approvals are
secured. Mockups may be required.
2. Protection may be required to remain in place for the duration of the Project. As such,
materials shall be installed to provide adequate protection throughout the full extent of
construction activities. Repair or reinstall protection as required throughout the
duration of construction. Changes to protection shall be proposed to the Architect for
approval prior to making changes.
3. All protection assemblies should be self-supporting and self bracing, and secured at
the base, unless otherwise noted.

3.6 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction
and as indicated. Use methods required to complete Work within limitations of governing
regulations and as follows:
1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use
cutting methods least likely to damage construction to remain or adjoining
construction. To minimize disturbance of adjacent surfaces, use hand or small power
tools designed for sawing or grinding, not hammering and chopping. Temporarily
cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring
existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At
concealed spaces, such as duct and pipe interiors, verify condition and contents of
hidden space before starting flame-cutting operations. Maintain portable fire
suppression devices during flame-cutting operations.
4. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and
promptly dispose of off-site.
6. Dispose of demolished items and materials promptly.
7. Return elements of construction and surfaces to remain to condition existing before
start of selective demolition operations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures
with construction to remain, using power-driven masonry saw or hand tools; do not use
power-driven impact tools.
1. Use a pacometer to locate all existing rebar within any existing concrete to be
demolished. Before drilling or cutting any rebar, obtain bar-by-bar permission in
writing from the Architect.

3.7 CUTTING AND PATCHING

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting
and patching at the earliest feasible time and complete without delay.
1. Cut existing construction to provide for installation of other components or
performance of other construction activities and the subsequent fitting and patching
required to restore surfaces to their original condition.
B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original installer; comply with the original installer’s recommendations.
   1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
   3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
   4. Comply with requirements of applicable Sections where cutting and patching requires excavating and backfilling.
   5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
   1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
   2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.
   4. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal
   1. Transport demolished materials off the District’s property and legally dispose of them.
   2. When hauling is done over highways or city streets, loads shall be trimmed and the vehicle shelf areas cleaned after each loading.
   3. Contractor shall pay all permit and disposal fees for off-hauled materials.
3.9 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. All residue and debris from protection work shall be removed from existing construction leaving the premises clean and neat.

3.10 SELECTIVE DEMOLITION SCHEDULE

A. Remove the Following: Demolished site construction materials.

END OF SECTION
SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 01 Specification sections, apply to work of this section.

1.2 SUMMARY

A. Section includes formwork, shoring, falsework, bracing, and other temporary supports required to form and support all cast-in-place concrete shown on the drawings including but not limited to all slabs, curbs, and equipment pads.

B. Related Sections

1. Section 03 20 00 – Concrete Reinforcement

2. Section 03 30 00 – Cast-in-Place Concrete

1.3 REFERENCES

A. Definitions

1. Formwork: The total system of support for freshly placed concrete, including the mold or sheathing that contacts the concrete and all supporting members, hardware, and necessary bracing.

2. Professional Engineer: A professional engineer who is licensed to practice engineering in the state where the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with concrete formwork that are similar to that indicated for this Project in material.

3. Shores: Vertical or inclined support members designed to carry the weight of formwork, concrete, and construction loads above.

1.4 CODES AND STANDARDS

A. Comply with the provision of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1. California Code of Regulations, Title 24, 2016 edition, also known as California Building Code (CBC), with Division of the State Architect (DSA) amendments.

2. ACI 301 "Specifications for Structural Concrete for Buildings"

3. ACI 318 "Building Code Requirements for Reinforced Concrete"
4. ACI 117 "Specifications for Tolerances for Concrete Construction and Materials"
5. ACI 347, “Guide to Formwork for Concrete.”
7. Concrete Reinforcing Steel Institute "Manual of Standard Practice"

1.5 RESPONSIBILITY

A. The design, construction and safety of all formwork shall be the responsibility of the General Contractor. All forms, shores, backshores, falsework, bracing, and other temporary supports shall be engineered to support all loads imposed including the wet weight of concrete, construction equipment, live loads, lateral loads due to wind and wet concrete imbalance. The Contractor shall also be responsible for determining when temporary supports, shores, backshores, and other bracing may be safely removed.

B. The design of all concrete formwork, formwork removal, and shoring requirements shall be performed by a California registered professional engineer experienced in the design of concrete formwork. The Contractor shall employ the formwork engineer.

C. Formwork shall conform to ACI 347

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Licensed Professionals: The formwork design engineer retained by the Contractor shall be a professional engineer registered in the state where the project is located and shall be experienced in the design of concrete formwork.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Non-specific formed concrete: Unless otherwise specified, the default finish for formed surfaces shall be rough-form finish constructed with plywood, lumber, metal or other acceptable material. Lumber shall be dressed on at least two edges and one side for tight fit. The minimum grade shall be B-C, exterior grade.

B. Smooth-Formed Finished Concrete: Formwork for exposed concrete surfaces as defined by the Surface Finish Class noted on the drawings, shall consist of plywood, metal, metal framed plywood, or other acceptable surface. Formwork shall provide a continuous straight and smooth surface conforming to the joint system as specified on the Architect's drawings. Form material shall have sufficient thickness to withstand pressure of concrete without bow or deflection. Plywood shall be exterior grade plywood panels, suitable for
concrete forms, complying with U.S. Product Standard PS-1, each piece bearing a legible inspection trademark, and as follows:

1. Medium Density Overlay on Hardwood Face, Class 1 or better, mill release agent treated and edge sealed.

C. Formed surfaces designated as “Architectural Concrete” on the Architectural Drawings: Use overlaid plywood complying with U.S. Product Standard PS-1 “A-C or B-B High Density Overlaid Concrete Form”, Class 1.

2.2 TOPS OF DRILLED PIERS, COLUMN BASES, AND SUPPORTS

A. Round section members shall be formed with metal, fiberglass, reinforced plastic, paper or fiber tubes, unless otherwise specified. Paper or fiber tubes shall be constructed of laminated plies using water-resistant adhesive with wax impregnated exterior for weather and moisture protection. Units shall have sufficient wall thickness to resist loads imposed by wet concrete without detrimental deformation. Forms shall be lined or otherwise fabricated so as to produce seamless concrete members.

2.3 FORMWORK COATINGS

A. Formwork coatings shall be of a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces or impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede curing with water or curing compounds. Provide a product that has a maximum VOC (Volatile Organic Compounds) of 50 g/l but not greater than that permitted by the local government agency having jurisdiction in the area where the project is located.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Dayton Superior; Bio-Release EF.
2. Unitex; Farm Fresh.
3. Universal Form Clamp; Bio-Form.
4. US Spec; Aqua Blue.

2.4 NAILS AND FASTENERS

A. Use only galvanized nails and fasteners for securing formwork in structures exposed to weather or unconditioned spaces such as garages, canopies and porte-cocheres.

2.5 FORM TIES

A. Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to minimize spalling of concrete on removal.

1. Exposed Surfaces: For surfaces designated with Surface Finish Class SF-2.x or SF-3.x, furnish units that will leave no portion of the tie closer than 3/4 inch to the plane of the concrete surface and that will leave holes not larger than 1 inch in diameter in concrete surface when the ends or end-fasteners have been removed.
2. Dampproofed Surfaces: Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

3. Exposed to Weather or Unconditioned Space: Provide removable, glass-fiber-reinforced plastic, stainless steel, or galvanized form ties that will leave no corrodible metal closer than 1 1/2 inches in surfaces that will be exposed to weather or in an unconditioned space in the final structure. The ties shall leave holes no larger than 1 inch in diameter in concrete surfaces when the ends or end-fasteners are removed.

2.6 CHAMFER STRIPS

A. Provide wood, metal, PVC, or rubber strips, ¾ by ¾ inch, minimum.

2.7 POLYSTYRENE FOAM BOARD

A. Provide rigid, cellular polystyrene boards which conform to ASTM D6817, with a minimum compressive strength of 15 psi at 1% deformation. Subject to compliance with requirements, acceptable manufacturers include:

1. “STYROFOAM Brand Square Edge” (XPS 26) Dow Chemical Company
2. “R-Control EPS Geofoam” - All grades, R-Control Building Systems
4. “Knauf Geofoam”, Knauf Polystyrene

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine excavated areas where formwork will be constructed and verify:

1. Excavations are adequate to permit placement, inspection and removal of forms.
2. Excavations for earth forms have been accurately and neatly cut.
3. Proper conditions are present for formwork construction

B. Contractor shall inspect formwork to verify that conditions meet ACI 347 and the requirements of the construction documents.

3.2 EARTH FORMS

A. Construct wood edge strips at top sides of excavations

B. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.

C. Remove loose dirt and debris prior to concrete placement.

D. Foundation concrete may be placed directly into neat excavations provided the trench walls are stable as determined by the Geotechnical engineer, subject to the approval of DSA.
1. The plan dimension of unformed footings shall be increased 1 inch at every surface at which concrete is placed directly against the earth.

E. The minimum formwork described herein is mandatory to ensure clean excavations immediately prior to and during the placing of concrete.

3.3 FABRICATION AND CONSTRUCTION

A. Design, erect, support, brace and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic construction loads that might be applied until the concrete structure can support such loads.

B. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

D. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and patch forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as indicated, using specified chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

3.4 CONSTRUCTION JOINTS

A. Provide construction joints per ACI 318 Section 26.5.6 where shown on the structural drawings, the approved shop drawings, or as directed by the Architect, subject to the review and approval of DSA.

B. The surface of all horizontal construction joints shall be cleaned and roughened by exposing clean aggregate solidly embedded in mortar matrix to ¼” amplitude.
3.5 CLEANING AND TIGHTENING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and all other debris just prior to concrete placement. Retighten forms and bracing prior to concrete placement as required to prevent mortar leaks and maintain proper alignment.

3.6 CLEANING AND RE-USE OF FORMS

A. Forms reused in the work shall be repaired and cleaned. Split, frayed, delaminated, or otherwise damaged facing material will not be acceptable for exposed surfaces. Forms intended for successive concrete placement shall have surfaces cleaned, fins and laitance removed, and joints tightened to avoid surface offsets. New form coating compound shall be applied to reused forms. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.7 TOLERANCES

A. Unless specified otherwise, all tolerances for concrete formwork shall conform to ACI Standard 117, "Standard Tolerances for Concrete Construction and Materials". Before concrete placement the Contractor shall check lines and levels of erected formwork and make any corrections and adjustments as required to ensure proper size and location of concrete members and stability of forming systems. During concrete placement the Contractor shall check formwork and supports to ensure that forms have not displaced and that completed work will be within specified tolerances.

B. Construct forms so as to limit the offset between adjacent pieces of formwork facing material in accordance with the surface tolerance class as defined in ACI 117 corresponding to the surface finish class noted on the drawings. The offset limits shall apply to both abrupt and gradual variations in the surface.

3.8 SHORES AND SUPPORTS

A. Comply with requirements of ACI 301 for shoring in concrete construction and as herein specified where more stringent.

B. Design: Shores must be designed to carry all loads transmitted to them. A rational analysis shall be used to consider, but shall not necessarily be limited to, the following:

1. Structural design load of the slab or member including live load, partition loads, and other loads for which the engineer designed the slab. The reduced live load and an allowance for construction loads shall be taken into consideration when performing the analysis.

2. Dead load weight of the concrete and formwork.
3. Construction live loads, such as placing crews and equipment or stored materials.
5. Strength of concrete at time it is required to support shoring loads from above.
6. The distribution of loads at the time of placing concrete, stripping formwork, and removal of shores.
7. Span of slab or structural member between permanent supports.
8. Type of formwork systems, i.e., span of horizontal formwork components, individual shore loads, etc.
9. Minimum age where appropriate.
10. Alignment of shores.

3.9 REMOVAL OF FORMS AND SUPPORTS

A. Determination by Contractor's Registered Engineer: The Contractor's registered engineer shall determine and submit for District's record the time and sequence of formwork and shore removal subject to the criteria as specified below.

B. Determining in situ Strength of Concrete: The General Contractor shall be responsible for making and curing concrete cylinders, cured under field conditions, for the purpose of determining concrete strength at time of form and shore removal. Such cylinders shall be made by the Contractor and tested by his testing laboratory.

C. Records of Weather Conditions: The General Contractor shall be responsible for keeping records of weather conditions to be used in the decision on when to remove forms.

D. Formwork Not Supporting Concrete: Formwork not supporting concrete such as sides of beams, walls, columns and similar parts of the structure, may be removed after cumulatively (not necessarily consecutively) curing at not less than 50°F for 24 hours after placing concrete, provided the concrete is sufficiently hard so as not to be damaged by form removal operations and provided curing and protection operations are maintained. If ambient air temperatures remain below 50°F, if retarding agents are used, or if Type II and Type V Portland cement is used, then this specified minimum period should be increased as required to safely remove the forms without damage to the concrete. Where such forms also support formwork for slab or beam soffits, the removal times of the latter shall govern.

E. Formwork Supporting Weight of Concrete: Formwork supporting weight of concrete such as beam soffits, joists, slabs and other structural elements shall not be removed until concrete has attained at least the following percentages of the design compressive strength:

- Beam Bottoms - 75%, but not less than 2800 psi
- Slabs - 75%, but not less than 2800 psi

F. Placing Shores:
1. All shoring operations shall be carried out in accordance with a planned sequence as determined by the Contractor's shoring engineer.

2. Shoring operations shall be performed so that at no time will areas of new construction be required to support combined dead and construction loads in excess of the available strength as determined by the design loads (as specified in the General Notes) and the developed concrete strength (as determined by field cured cylinders) at the time of stripping.

3. Shores shall not be removed until the structural member supported has sufficient strength to support all applied loads.

### 3.10 FIELD QUALITY CONTROL

A. Field Inspection

2. Shallow Foundation Elements:
   a. Verify element width, length, depth, and elevation.
   b. Verify that forms are plumb and straight, braced against movement, and lubricated for removal.

3. Slabs-on-Grade
   a. Verify formwork at turndowns and slab edges is plumb and straight, braced against movement and lubricated for removal.

4. Curbs and Piers
   a. Verify that forms are plumb and straight, braced against movement, lubricated for removal, and conform to approved shop drawings.
   b. Verify proper dimensions, elevations and orientation.

END OF SECTION
SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections apply to work of this section.

1.2 SUMMARY

A. The work of this section includes labor, materials, hardware, equipment, transportation and services required to fabricate and place all reinforcement for cast-in-place concrete including bars, welded wire fabric, ties and supports shown on the drawings and as specified.

B. Related Sections

1. Section 03 10 00 – Concrete Formwork
2. Section 03 30 00 – Cast-in-Place Concrete
3. Section 04 22 00 – Reinforced Concrete Masonry

1.3 REFERENCES

A. Codes and Standards: Comply with all provisions of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1. California Code of Regulations, Title 24, 2016 edition, also known as California Building Code (CBC), with Division of the State Architect (DSA) amendments.
2. ACI 301 - "Specifications for Structural Concrete for Buildings".
3. ACI 117 - 'Specifications for Tolerances for Concrete Construction and Materials."
5. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".
6. ANSI/AWS D1.4 “Structural Welding Code – Reinforcing Steel”

1.4 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings for all reinforcing steel and related accessories for the Engineer's approval. Shop drawings shall show arrangement and layout, bending
and assembly diagrams, bar schedules, stirrup spacing, splicing and laps of bars and shall be prepared in accordance with CRSI Standards.

2. Submit shop drawings indicating which members, if any, will use fusion welding process for assembly. Shop drawings shall show complete structural details indicating the size of stirrups, the size of holding wires, and welding requirements.

**B. Mill Certificates:** Submit, for record, mill certificates and/or test results signed by Contractor and Producer, for all reinforcement.

**C. Product Data:** Submit manufacturer’s product data with application and installation instructions for proprietary materials and items, including mechanical splices, hooked anchorage systems, large-headed stud punching shear reinforcement, dowel bar substitute systems, and dowel bar sleeves.

**D. International Code Council (ICC) Evaluation Service Reports:** Submit evaluation service reports of approval from ICC Evaluation Service, Inc. for mechanical splices.

**E. Special Procedure Submittals:** Submit shop welding program for fusion welding including the type of the specific fusion welding machine and the quality control/inspection protocol for the shop welding.

**F. Qualification Statements:** Submit welding certificates.

**1.5 QUALITY CONTROL**

**A.** The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

**B.** The Reinforcing-Placing subcontractor shall attend the Pre-Concrete Conference conducted by the Concrete Contractor as described in Specification Section “Cast-in-Place Concrete”.

**1.6 TESTING AND INSPECTION**

**A.** Perform all tests and inspections of reinforcing steel as specified herein.

**B.** Any testing laboratory retained to run tests required by this specification shall meet the basic requirements of ASTM E 329.

**C.** Provide inspection of welding, including fit-up, welding equipment, weld quality and welder certification in accordance with AWS D1.4. Where bars do not conform to ASTM A706, chemical analysis shall be made of representative bars to be welded, sufficient to determine carbon equivalent and minimum preheat temperature. Comply with the requirements of CBC Section 1903A.8 and ACI 318.26.6.4.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

**A.** Reinforcement:
1. Reinforcing materials shall be delivered from the mill in bundles that are identified as to heat number and manufacturer and accompanied with mill and analysis test reports and an affidavit from the supplier stating that the material conforms to the requirements of the governing ASTM specification listed herein.

2. Reinforcing steel sampling and testing per CBC 1910A.2:
   a. Where bundles are identified as to heat number and accompanied by mill analyses, one tensile test and one bend test shall be made from a specimen of each ten (10) tons, or fraction thereof, of each size and grade of reinforcing steel.
   b. When reinforcement is not positively identified by heat numbers or where random samples are intended, one tensile test and one bend test shall be made of each 2½ tons, or fraction thereof, of each size and grade of reinforcing steel.
   c. Tests of reinforcing bars may be waived by the structural engineer with the approval of DSA where certified mill test reports are provided to the Inspector of Record for each shipment of reinforcement.

3. Reinforcing Bars: Reinforcing bars shall conform to ASTM A615 Grade 60 as noted on the drawings.

4. Weldable Reinforcing Bars: All reinforcing bars noted on the drawings to be welded shall conform to ASTM A706 Grade 60.

5. Deformed Bar Anchors: AWS Type C studs manufactured in conformance with ASTM A 1064 with a minimum tensile strength of 80,000 PSI. Standard ASTM A615 Grade 60 or Grade 40 reinforcing bars may not be substituted for deformed bar anchors. The following are acceptable products, provided that their Evaluation Service Reports are still valid at the time of use on the project:
   b. Tru-Weld Division, TFP Corporation; Deformed Bar Anchors (ESR-2823)

7. Wire: Smooth wire for spiral reinforcement shall conform to ASTM A1064 with a minimum yield strength of 70,000 PSI.

8. Joint Dowel Bars: Smooth bars used to dowel across slab-on-grade construction joints shall conform to ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs.

9. Dowel Bar Sleeves: Plastic or gage metal (26 gauge minimum) sleeves with an inside diameter of 1/16 inch greater than the dowel bar that it encases, that have the strength, durability, and design to provide free movement of the dowel relative to the concrete slab and that are specifically manufactured for this purpose.

10. Plain Steel Welded Wire Reinforcement: ASTM A1064 with a yield strength of 65,000 PSI. Provide in flat sheets only.

11. Tie Wire: Tie wire shall be annealed steel tie wire, minimum 16 gauge.
a. Tie wire in architecturally exposed concrete shall be plastic coated or stainless steel.

12. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations.
   a. Slabs-on-Grade: Use precast concrete bar supports (dobies) or supports with sand plates or horizontal runners designed for use on ground.
   b. Spread Footing and grade beam bottom reinforcement: Use precast concrete bar supports (dobies) or chairs designed for soil-supported slabs.
   c. Exposed to View Concrete: Provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
   d. Where bar supports do not come into contact with exposed concrete surfaces: CRSI Class 3.

2.2 SPLICES

A. Mechanical Tension Splices:

1. Mechanical splices shall conform to Type 1 splices, typical unless otherwise noted on the structural drawings.
   a. Type 1 splice shall develop 1.25 times the specified yield strength of the splice bar.
   b. Type 2 splice shall meet the requirements of Type 1 splice and, in addition, develop the full tensile strength of the splice bar.

2. The bar ends that are to attach to the splice shall be prepared and installed in accordance with the manufacturer’s requirements.

3. Splices shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Report submitted for Engineer review. The following are acceptable mechanical tension splices (splices qualified for use with grade 75 bars are parenthetically noted):
   a. BarSplice Products, Inc.; BPI-Grip XL System (ESR-2299). (Type 1 or Type 2)
   b. BarSplice Products, Inc.; Taper Threaded Grip-Twist System (ESR-2299). (Type 1 or Type 2)
   c. BarSplice Products, Inc.; Position Taper Threaded Grip-Twist System (ESR-2299). (Type 1 or Type 2)
   d. Headed Reinforcement Corporation; HRC 500/510 Xtender Mechanical Coupler System (ESR-2764). (Type 1 or Type 2)
   e. Dayton Superior Corporation; DBDI Reinforcing Bar Mechanical Splice System (ESR-2649). (Type 1 or Type 2).
   f. Dayton Superior Corporation; Bar-Lock Coupler Systems for Splicing Reinforcement Bars, S-Series (ESR-2495). (Type 1)
g. Dayton Superior Corporation; Bar-Lock Coupler Systems for Splicing Reinforcement Bars, L-Series (ESR-2495). (Type 1 or Type 2)

h. Dayton Superior Corporation; Taperlok Reinforcing Bar Mechanical Splice Couplers (ESR-2481). (Type 1 or Type 2)

i. BarSplice Products, Inc.; ZAP Screwlok (qualified for use with grade 75 bars) (ER-5461). (Type 1 and Type 2)

j. Erico Products, Inc.; Lenton Coupler (ER-3967). (Type 1 or Type 2) (for grade 75 bars #9 and larger, use only Standard Coupler).

k. Splice Sleeve North America; NMB Splice-Sleeve (ER-5645). (Type 1 or Type 2).

PART 3 - EXECUTION

3.1 FABRICATION AND DELIVERY

A. Bending and Forming: Fabricate bars of indicated sizes and accurately form to shapes and lengths indicated and required, by methods not injurious to materials. Do not heat reinforcement for bending. Bars shall be free from injurious defects, have a workman-like finish with no excessive rust and/or pitting and have no unusual kinks or bends.

B. Marking and Shipping: Bundle reinforcement and tag in accordance with Section 7.4.5 of the CRSI “Manual of Standard Practice”. Transport and store at site so as not to damage material. Keep sufficient supply of tested, approved and proper reinforcement at the site to avoid delays. Maintain reinforcing bars free of mud, dirt, grease, or other coating.

3.2 PLACING REINFORCEMENT

A. Comply with CRSI recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.

B. Before placing reinforcement and again before concrete is placed, clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs, runners, bolsters, spacers and hangers, as required. Exercise particular care to maintain proper distance and clearance between parallel bars and between bars and forms. Provide spreaders and spacers to hold steel in position. Support steel at proper height upon approved chairs.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set tie wires so ends are directed into concrete, not toward exposed concrete surfaces.

E. Support of Spread Footing Reinforcing Steel

1. Bottom Steel: Support bottom reinforcing mat to provide the specified clearance to the bars. Spacing between supports shall not exceed 4'-0" centers each way.
2. **Top Steel:** Support top reinforcing on steel angle frames braced in both directions or on special standee support bars. Spacing between supports shall not exceed 4'0" centers each way. The depth of the supports shall provide the specified clearance from the bars to the top of the concrete. The design of the support steel shall be the responsibility of the Contractor.

F. Install welded wire reinforcement in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two inches and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

G. Coordinate with other trades and expedite materials and labor to avoid omissions and delay.

H. Install waterproof membrane or vapor barrier as specified prior to placing steel for concrete slabs-on-grade.

I. Extend reinforcement continuous through construction joints unless otherwise shown on the drawings.

J. **Slab-on-Grade Joint Dowel Bars:** Support slab-on-grade joint dowel bars independently of support for slab reinforcement on soil supported slab bolsters or specially manufactured cradles such that dowel bar remains parallel to slab surface and at right angles to joint during concreting operations. Lightly coat the exposed end of the dowel with a paraffin-base lubricant, asphalt emulsion, form oil, or grease or use a dowel bar sleeve.

K. Provide and place additional reinforcing steel at all sleeves and openings in beams, slabs and walls as specified on the drawings. Where sleeves or openings not shown on the drawings interrupt the reinforcement, consult with Engineer for instructions for placing and splicing of bars. Provide required additional reinforcing steel at no additional cost to the District.

3.3 **SPlicing Reinforcing Steel**

A. Provide splice as indicated on the drawings. Splice reinforcing bars only at locations shown on the structural drawings and approved shop drawings. Unauthorized or unscheduled splices not approved by the Engineer in writing will not be accepted.

B. All lap splices in reinforcing steel shall be contact lap splices unless detailed otherwise on the drawings.

C. Maintain proper cover between reinforcing bars at splices.

D. Lap reinforcing bars as noted on the structural drawings. Lap welded wire fabric a minimum of one full wire mesh plus two inches.

E. Manufacturer of mechanical tension splice shall be present for first day's installation.

3.4 **Welding Reinforcing Steel**

A. Welding reinforcing steel is permitted only where specifically shown on the drawings. All welding shall conform to AWS D1.4. Only weldable reinforcing steel conforming to
ASTM A 706 or deformed bar anchors conforming to ASTM A 496 shall be permitted. ASTM A 615 bars may not be welded for structural use.

B. Tack welding of reinforcement shall not be permitted.

C. Fusion welding of preassembled cages shall be permitted only under the following conditions and as specified in CBC 1903A.8:

1. Fusion welding of holding wires to ties, stirrups, and hoops in beams, columns and grade beams to preassemble reinforcing cages is permissible. The holding wire area shall not exceed 5% of the beam, column or grade beam cross sectional longitudinal steel area. Fusion welding is not allowed to longitudinal reinforcing steel in any beam, column or grade beam.

2. Fusion welding of holding wires to the ends of the reinforcing steel placed in mats (spread footings, slab reinforcement, etc.) is permitted provide the fusion weld occurs within 6 bar diameters of the free end of the bar (e.g. not allowed at the end of coupled, T-headed, or weld spliced bars).

3. Fusion welding of holding wires shall not occur on a bent portion of a reinforcing bar. Bars may not be bent where a fusion weld occurs.

4. Holding wires shall conform to ASTM A496.

5. All reinforcing steel to be welded shall comply with ASTM A706.

6. Submit complete structural plans indicating which members will use fusion welding process for assembly. Provide complete structural details indicating the size of stirrups and holding wires and welding requirements. Submit a complete shop welding program which includes the following: a) Type of the specific fusion welding machine; b) Periodic inspection protocol of the in-plant welding. This information shall be submitted to the Structural Engineer (SEOR) and Inspector of Record (IOR) for approval. Fusion welding and fabrication is not permitted until approved by the SEOR and IOR.

3.5 SHRINKAGE AND TEMPERATURE REINFORCEMENT

A. Provide shrinkage and temperature reinforcement as indicated on the drawings at right angles to main top and bottom bars for all structural slabs unless detailed otherwise on the drawings.

3.6 PLACEMENT OF WELDED WIRE REINFORCEMENT

A. Wherever welded wire reinforcement is specified as reinforcement in pan-formed beams or slabs, it shall be continuous and properly lapped one full wire spacing plus 2” across the entire concrete surface and not interrupted by beam or girders.

3.7 REINFORCEMENT IN GRADE BEAMS

A. Provide reinforcing in grade beams as shown on the drawings.
B. Bar Support for Grade Beam Cages: Grade beam bottom steel shall be supported at 5'-0" maximum centers using beam bolsters that provide 3" bottom cover to the reinforcing steel. Beam bolsters used shall be designed and manufactured for support on soil.

3.8 REINFORCEMENT IN TOPPING SLABS AND FILL IN METAL PANS

A. Provide welded smooth wire reinforcement minimum 6 x 6 W1.4 x W1.4 in all topping slabs and fill at metal pans unless specified otherwise on the drawings.

3.9 REINFORCEMENT IN HOUSEKEEPING PADS

A. Provide welded smooth wire reinforcement 6 x 6 W2.9 x W2.9 minimum in all housekeeping pads supporting mechanical equipment unless detailed otherwise on the drawings.

3.10 REINFORCEMENT IN SIDEWALKS

A. Provide welded smooth wire reinforcement minimum 6 x 6 W1.4 x W1.4 in all sidewalks unless detailed otherwise on the Architectural, Civil, Landscape or Structural Drawings.

3.11 MECHANICAL AND PLUMBING REQUIREMENTS

A. Refer to Mechanical and Plumbing Drawings for concrete requiring reinforcing steel. Such reinforcement shall be furnished as part of the work of this section.

3.12 FIELD QUALITY CONTROL

A. The District will engage a qualified DSA approved testing and inspection agency (The District’s Testing Laboratory) and a special inspector (IOR) to perform field tests and inspections and prepare test reports.

B. Special Inspections:

1. Steel reinforcement placement. Inspect 100% of reinforcement before each concrete pour to verify the information noted below:
   a. Primary and secondary, longitudinal reinforcement has correct size and number in proper layers.
   b. Longitudinal reinforcement has correct length and lap.
   c. Ties and stirrups are of correct size, spacing, and number and have the proper termination-hook geometry.
   d. Unscheduled face reinforcement in beams are provided and are of correct size, number and spacing and have the proper end terminations.
   e. Proper hooks are provided at bar ends as detailed.
   f. Reinforcement is properly supported and braced to formwork to prevent movement during concreting operation.
   g. Reinforcement has proper cover.
   h. Sufficient spacing between reinforcement for concrete placement.
   i. Dowel reinforcement is of proper size, at proper spacing, and has proper lap length and embedment length.
j. Welded wire reinforcement is composed of flat sheets, has proper wire gage and spacing, is properly supported, and is properly lapped.
k. Proper Construction/Contraction/Expansion joint spacing and reinforcement.
l. Reinforcement around embedded items is installed according to details.

2. Steel reinforcement welding: Periodic inspection of the welding of reinforcing bars to assure compliance with the requirements of AWS D1.4.

3. Mechanical Tension Splices:

a. The Laboratory shall provide 100% visual inspection of mechanical tension splices on the project and consult the ICC-ESR report and manufacturer regarding recommendations for installation. Inspection shall verify compliance with specifications and ICC-ESR report, and conformance with the manufacturer's recommendations for installation. The manufacturer shall be present for the first installation of the splice on the project.

END OF SECTION
SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary 
   Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SUMMARY

A. Extent of structural concrete work is shown on drawings, including schedules, notes and 
   details which show size and location of members and type of concrete to be poured. 
   Furnish all labor, materials, services, equipment and hardware required in conjunction with 
   or related to the forming, delivery and placement of all poured-in-place concrete work. 
   Concrete paving and walks are specified in other Sections.

B. Related Sections

1. Section 03 10 00 – Concrete Forming
2. Section 03 20 00 – Concrete Reinforcing
3. Section 03 35 00 – Concrete Finishes
4. Section 04 22 00 – Reinforced Concrete Masonry
5. Section 05 12 00 – Structural Steel
6. Section 07 26 00 – Vapor Retarder

1.3 REFERENCES

A. Codes and Standards: Comply with provisions of following codes, specifications and 
   standards, except where more stringent requirements are shown or specified:

1. California Code of Regulations, Title 24, 2016 edition, also known as California 
   Building Code (CBC), with Division of the State Architect (DSA) amendments.
2. ACI 301 – “Specifications for Structural Concrete for Buildings”.
3. ACI 117 – “Specifications for Tolerances for Concrete Construction and 
   Materials.”
4. ACI 305 – “Recommended Practice for Hot Weather Concreting”
5. ACI 318 – “Building Code Requirements for Reinforced Concrete”.

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1.4 QUALIFICATIONS

A. The concrete supplier shall have a minimum of five years’ experience in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment. The supplier must be certified according to the National Ready Mixed Concrete Association’s Certification of Ready Mixed Concrete Production Facilities.

B. The concrete contractor shall have a minimum of five years’ experience with installation of concrete similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful service performance.

C. Any testing laboratory retained to run tests required by this specification shall meet the basic requirements of ASTM E 329.

1.5 QUALITY CONTROL

A. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

B. Document Conflict and Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.

C. Inspection and Testing of the Work: Materials and installed work may require testing and retesting, as directed by the DSA, or the Architect/Engineer, at any time during progress of work.

1. The Contractor shall provide adequate notification to the IOR and the District’s Testing Agency of construction operations including the project schedule to allow the Testing Agency to schedule inspections. Failure to sufficiently notify may result in additional costs incurred by the Testing Laboratory that may be back-charged to the Contractor by the District.

2. The Contractor shall cooperate with laboratory personnel, provide access to the work, and to manufacturer's operations.

3. The Contractor shall make adequate arrangement with the IOR and the District’s Testing Agency for inspection of material stockpiles and facilities.

4. The Contractor shall provide to the IOR and Laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.

5. The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the laboratory and otherwise facilitate the required inspections and tests.
D. Inspection or testing by the District does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents. Tests not specifically indicated to be done at the District’s expense, including retesting of rejected materials and installed work, shall be done at the Contractor’s expense. Acceptance Criteria for Concrete Strength: The strength level of an individual class of concrete shall be considered satisfactory if both the following requirements are met:

1. The average of all sets of three consecutive strength tests equal or exceed the required $f'_c$.
2. No individual strength test falls below the required $f'_c$ by more than 0.1 $f'_c$ or 500 psi, whichever is greater.
3. A strength test is defined as the average strength of two 6” x 12” cylinder breaks or three 4” x 8” cylinder breaks tested at the strength age indicated on the drawings for that class of concrete.

E. Responsibility for Selection and Use of Concrete Admixtures and Chemical Treatments: The Contractor shall be responsible for selecting admixtures and surface treatments that are compatible with the intended use of the concrete including all final surface treatments called for within this or other specifications or on the structural or architectural drawings. The Contractor is responsible for following the manufacturer’s instructions for the use of their product including abiding by any limitations placed by the manufacturer on the use of any of its products.

F. Manufacturer Representative Presence:

1. Post-installed anchors: The manufacturer’s representative for each post-installed anchor product (adhesive, expansion, undercut, screw, or insert anchor) shall be present during the first day’s installation of the product to observe whether the anchors are installed according to manufacturer’s instructions.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer’s product data with application and installation instructions for proprietary materials and items, including admixtures, epoxies, grouts, joint systems, curing compounds, sealers mechanical splices, hooked anchorage systems, dowel bar substitute systems, dowel bar sleeves, joint fillers, and others as requested by Architect/Engineer.

B. Samples: Submit samples of materials specified if requested by Architect/Engineer, including names, sources and descriptions.

C. Mix Designs: Submit mix designs as specified herein.

D. Material and Mill Certificates: Provide material and mill certificates as specified herein and in the Testing Laboratory section of the Specifications. The Manufacturer and Contractor shall sign the material and mill certificates certifying that each material item complies with specified requirements. Provide certification from admixture manufacturers that chloride ion content complies with specified requirements.
E. Construction Joints: Submit drawing of proposed construction joint locations in concrete for slab on grade, mat foundations, structural floors, roofs and walls. Submit any additional or changed reinforcing that is required at construction joints that differs from that shown on the drawings.

F. Minutes of preconstruction conference.

G. Surveys: Submit report certifying that all anchor rods and reinforcing dowels into columns above are in their proper location prior to placing of concrete.

1.7 PROVISION FOR OTHER WORK

A. Provide for installation of inserts, hangers, metal ties, anchors, bolts, angle guards, dowels, thimbles, slots, nailing strips, blocking, grounds and other fastening devices required for attachment of work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves in any concrete slabs, beams or columns except where shown on the drawings or upon written approval of the Architect/Engineer.

B. Protect adjacent finish materials against damage and spatter during concrete placement.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Refer to the drawings for classes and strengths of concrete required.

B. Hydraulic Cement:
   
   1. Use ASTM C 150, Type II.
   
   2. Use one brand of cement, for each class of concrete, throughout the project, unless approved otherwise by the Architect/Engineer and the District’s Testing Laboratory. Submit mill certificates certifying conformance to this specification for each brand and type of cement.
   
   3. Testing of cement in lieu of mill certificate submittal will be required if:
      
      a. The cement has been in storage at the mixing site for over 30 days
      b. It is suspected by the District, Architect, Engineer or District’s Testing Laboratory that the cement has been damaged in storage or in transit or is in any way defective.

C. Low-alkali cement: Cement that has the additional requirement that equivalent alkalis (Na₂O + 0.658K₂O) do not exceed 0.60% according to ASTM C 150-00, Table 2.

D. Fly Ash: ASTM C 618, Class F.

E. Slag Cement: ASTM C 989, Grade 100 or 120, or ASTM C 595, Type IS or Type S.

F. Normal Weight Aggregates: ASTM C 33, and as herein specified. Submit material certificates from aggregate supplier or test results from an independent testing agency certifying conformance to this specification for each source of aggregate.
1. For concrete identified on the drawings as exposure classes C1 and C2, submit certification that aggregate does not contain any deleterious materials that react with alkalis in the concrete mix to cause excessive expansion of the concrete for concrete that is exposed to wetting, has extended exposure to humid atmosphere, or is in contact with moist ground unless low-alkali cement is used.

G. Water: Comply with the requirements of ASTM C 1602

2.2 ADMIXTURES


Subject to compliance with requirements, provide one of the following products and manufacturers:

"Darex" or "Daravair" series; W. R. Grace & Co.
"MB-VR", "MB-AE90" or "Micro-Air"; BASF Admixtures, Inc
"Sika AER"; Sika Corporation
"Air Mix" or "AEA-92"; The Euclid Chemical Company
“Eucon Air 30” or “Eucon Air 40”, The Euclid Chemical Company.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

B. Water-Reducing Admixture: ASTM C 494, Type A. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Pozzolith" series; BASF Construction Chemicals
"Plastocrete 161"; Sika Chemical Corp.
"Eucon WR-75 or WR-91"; The Euclid Chemical Company.
"WRDA ";series W.R. Grace & Co.
“Eucon NW” or “Eucon LW”, The Euclid Chemical Company.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

C. Mid-Range Water-Reducing Admixture: ASTM C 494, Type A and Type F. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

“Polyheed” series, BASF Construction Chemicals
“Eucon MR”, The Euclid Chemical Company
“Sikament HP”, Sika Chemical Corp.
“Daracem” or “Mira” series, W.R. Grace & Co.
“Eucon X15” or “Eucon X20”, The Euclid Chemical Company.
Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

D. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"ADVA" or "Daracem" Series; W.R. Grace & Co.
"Rheobuild 1000" or "Glenium" series; BASF Construction Chemicals
"Sikament"; Sika Chemical Corp.
"Eucon 37/1037" or "Plastol" series; The Euclid Chemical Company
  “Eucon SP” or “Eucon RD”, The Euclid Chemical Company

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

E. Water-Reducing, Accelerator Admixture (Non-Corrosive, Non-Chloride): ASTM C 494, Type C or E. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Polarset","Gilco","Lubricon NCA” or “DCI”, W.R. Grace & Co.
"Pozzutec 20+”; BASF Construction Chemicals
"Accelguard 80/90"; “NCA”, or “AcN”, The Euclid Chemical Company
  “Plastocrete 161FL”, Sika Chemical Co.
  “Eucon AcN”, The Euclid Chemical Company

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

F. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Daratard" series, W.R. Grace & Co.
"Pozzolith" series or "DELVO” series; BASF Construction Chemicals
"Plastiment”; Sika Chemical Co.
  “Eucon Retarder”, Series, The Euclid Chemical Company

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

G. Calcium Chloride and Chloride Ion Content: Calcium chloride or admixtures containing more than 0.5% chloride ions by weight of the admixture are not permitted.
H. Certification: Written conformance to all the above mentioned requirements and the chloride ion content of the admixture as tested by an accredited laboratory will be required from the admixture manufacturer at the time of mix design review by the Engineer.

2.3 RELATED MATERIALS

A. Waterstops: Provide waterstops at joints where shown on the drawings. Size to suit joints. Provide flat, dumbbell type or centerbulb type.

1. ADCOR ES waterstops: W.R. Grace & Co.
2. Polyvinyl chloride (PVC) waterstops: Corps of Engineers CRD-C 572.

   Manufacturers: Synko-Flex Products, Inc.


B. Vapor Retarder: Refer to Specifications Section 07 26 00.

C. Slip-resistive Emery Aggregate or Aluminum Granule Finish: Provide fused aluminum-oxide granules, or crushed emery, as abrasive aggregate for slip-resistive finish. The emery aggregate shall contain not less than 50% aluminum oxide and not less than 20% ferric oxide. The aluminum aggregate material shall contain not less than 95% fused aluminum-oxide granules. Use material that is factory-graded, packaged, rust-proof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

Subject to compliance with requirements, provide one of the following:

- "Emery Tuff Non-Slip", Dayton-Superior
- "Grip-It" or “Grip-It AO”, L&M Construction Chemicals, Inc
- “Fritex NS”, Sonneborn-ChemRex

D. Sealers: Refer to specifications Section 03 35 00 Concrete Finishes.

E. Bonding Compound: Polyvinyl acetate or acrylic base, for use in cosmetic and/or nonstructural repairs.

Products: Subject to compliance with requirements, provide one of the following:

1. Acrylic or Styrene Butadiene:

   - "Day-Chem Ad Bond (J-40)"; Dayton Superior
   - "SBR Latex"; The Euclid Chemical Company
   - "Daraweld C"; W. R. Grace
   - "Acrylic Additive" BASF Building Systems
   - "SikaLatex", Sika Chemical Co.
   - "Intralok", W. R. Meadows
“Akkro 7-T”, The Euclid Chemical Company

2. Polyvinyl Acetate (Interior Use Only)

"Tammseld"; The Euclid Chemical Company
"Everweld"; L & M Construction Chemicals, Inc.
"Superior Concrete Bonder (J-41)," Dayton Superior

F. Epoxy Products: Two component material suitable for use on dry or damp surface, complying with ASTM C 881.

1. Products for Crack Repair:

"Sikadur 35 Hi Mod LV"; Sika Chemical Company – injection type
"Sikadur 52", Sika Chemical Company – injection type
"Sikadur 55 SLV", Sika Chemical Company – gravity feed
"Eucopoxy Injection Resin," The Euclid Chemical Company
"Sure-Inject (J-56)," Dayton Superior
“Epofil SLV”, BASF Building Systems
“ETI-LV” or “ETI-GV”, Simpson Strong-Tie Co., Inc. – injection type
“Rezi-Weld LV”, W. R. Meadows

2. Products for Epoxy Mortar Patches:

"Sikadur Lo-Mod LV"; Sika Chemical Corporation
"”Duracrete”, The Euclid Chemical Company
"Sure Grip Epoxy Grout (J-54)," Dayton-Superior
“Epofil”, BASF Building Systems
“Pro-Poxy 2500”, Unitex
“Rezi-Weld 1000”, W. R. Meadows
“Duralcrete LV”, The Euclid Chemical Company

3. Products for Adhesive Anchors or Reinforcing Steel in Normal weight Concrete:

Product that conforms to ASTM C 881-02, Type IV, Grade 3, Class A, B, & C except gel times, and that is dispensed from a two-component cartridge system through a mixing nozzle that thoroughly mixes the two components as it is injected into the hole.

a. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published, currently valid, Evaluation Report showing it as having passed Acceptance Criteria 308 shall be approved for use.
b. Consult with the manufacturer for the minimum temperature of the concrete substrate allowed.
c. All epoxy anchors require continuous inspection.
d. Normal weight Concrete:

“HIT-RE 500-SD”, Hilti Fastening Systems, ICC ESR-2322
“SET-XP” Adhesive”, Simpson Strong-Tie, ICC ESR-2508
G. Expansion Anchors in Concrete:

1. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published, currently valid, Evaluation Report showing it as having passed Acceptance Criteria 193 and approval for use in cracked concrete and resisting wind and seismic loads shall be approved for use.

2. Type: All expansion and undercut anchors in concrete shall be only wedge type expansion, sleeve-type expansion, or undercut type anchors.

3. Interior Use: All anchors, nuts and washers for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.

4. Exterior or Exposed Use: All anchors, nuts and washers for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors, nuts and washers shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel and nuts and washers from 300 series or Type 18-8 stainless steel.

5. Nuts and Washers: Nuts and washers shall be furnished from the manufacturer and used with the anchors.

6. Install only anchors identified on the drawings by manufacturer and product. Special inspection is required on all anchor installations.

H. Threaded Rods Chemically Anchored in Concrete

1. Type: Threaded rods installed in holes using a chemical anchoring process shall have a 45° chiseled end on one end.

2. Interior Application: Meet the requirements of ASTM A307, A36 or A193, grade B7.

3. Exterior Application: Meet the requirements of ASTM A153 galvanized steel, or F 593, Group 1 or 2, condition CW stainless steel.

I. Non-Shrink Grout:

1. Type: Grout for anchoring rebar in sleeves, base plates, bearing plates and grouting under precast or tilt-up wall panels shall be a non-metallic, shrinkage resistant, premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents and fluidity improving compounds.

2. Specifications: Non-shrink grout shall conform to ASTM C 1107.
3. Compressive Strength: Provide the minimum strength as shown below as
determined by grout cube tests at 28 days:

   a. Unless noted otherwise on the drawings, grout strength on supporting
concrete shall be 8000 psi.

4. Products: Acceptable non-shrink grouts are listed below:

   a. L&M Construction Chemicals, Inc.; Crystex.
   b. BASF Corporation; MasterFlow 713.
   c. BASF Corporation; MasterFlow 100.
   d. The Euclid Chemical Company; NS Grout.
   e. Dayton Superior Corporation, Inc; 1107 Advantage Grout
   f. Hilti, Inc.; Precision Grout.
   g. W.R. Meadows, Inc; CG-86 Grout.
   i. SpecChem, LLC; SC Multipurpose Grout

J. Reglets: Where resilient or elastomeric sheet flashing or bituminous membrane are
terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill
reglet or cover face opening to prevent intrusion of concrete or debris.

K. Bondbreaker for Construction Joints in Slabs-on-Grade: A dissipating bondbreaking
compound containing no silicones, resins, or waxes, and that conforms to ASTM C 309.
Subject to compliance with requirements, acceptable manufacturers include the following:

   “Sure-Lift”, Dayton Superior Corporation, Inc.
   SpecChem, LLC; SpecTilt 100.

L. Rigid-Cellular-Polystyrene Boards use as Fill under Topping Slabs, Equipment Pads, or
Slabs-on-Grade: Provide rigid, expanded (EPS) or extruded (XPS) cellular polystyrene
boards that conform to ASTM D 6817 or ASTM C 578 with a minimum density of 48
kg/m$^3$. Subject to compliance with requirements, acceptable manufacturers include the following:

   1. Dow Chemical Company; STYROFOAM Brand.
   2. Therma Foam; Foam-Control EPS Geofoam.
   3. Carpenter Co.; EPS Envirogreen Geofoam.
   4. Insulfoam; Insulfoam GF (EPS Geofoam)

2.4 PROPORTIONING AND DESIGN OF CONCRETE MIXES

A. The Contractor shall submit concrete mix designs for each class of concrete indicated on
the structural drawings and in the Specifications for approval by the Engineer and District's
Testing Laboratory at least 15 working days prior to the start of construction. If required,
the Contractor shall engage the services of an independent Testing Laboratory to assist in
preparing the mix design. The Contractor shall not begin work with a particular mix until
that mix design has been approved.
B. The Contractor, acting in conjunction with his Concrete Supplier and his Testing Laboratory, shall submit in writing, with his mix designs, the method used to select mix proportions.

1. For concrete with 15% or less fly ash (or other pozzolans) replacement of Portland cement (by weight), either of the following methods, as outlined in ACI 301 and ACI 318, may be used.
   a. Field Experience Method
   b. Laboratory Trial Mixture Method

C. Required types of structural concrete and compressive strengths shall be as indicated on the Structural Drawings.

D. All mix designs shall state the following information:

1. Mix design number or code designation by which the Contractor shall order the concrete from the Supplier.
2. Structural slab or member for which the concrete is designed (i.e., columns, shear walls, footings, slab on grade, etc.).
3. Wet and dry unit weight.
4. 28 day compressive strength.
5. Aggregate type, size, gradation, fineness modulus.
6. Cement type and brand.
7. Fly ash or other pozzolan type and brand (if any).
8. Admixtures including air entrainment, water reducers, high-range water reducers, accelerators, and retarders.
9. Design Slump or Slump/Flow.
10. Proportions of each material used.
11. Water/cementitious ratio and maximum allowable water content.
12. Method by which the concrete is intended to be placed (bucket, chute, or pump).
13. Required average strength qualification calculations per ACI 301 4.2.3.3a and 4.2.3.3b. Submit separate qualification calculations for each production facility that will supply concrete to the project.
14. Documentation of Average strength (trial mix data or field test data) per ACI 301: When field test data is used to qualify average strength, submit separate documentation for each production facility that will supply concrete to the project.
15. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Agency's reports from which the data was compiled.

E. Low Alkali Concrete: For concrete identified on the drawings as exposed to exposure classes C1 and C2, the total alkali contribution from cementitious materials in the concrete mix shall not exceed 4.0 pounds per cubic yard of concrete unless the aggregate used is certified to contain no deleterious materials that react with alkalis in the concrete mix as defined in ASTM C 33. This requirement may be met by the use of low-alkali cement.

F. Supplementary Cementitious Materials: Fly ash and/or ground granulated blast-furnace slag replacement of Portland cement shall be within percentage replacement levels listed on the drawings unless noted otherwise. Every effort should be made to reduce the amount of cement to the minimum practical amount, and still achieve performance requirements contained in the Contract Documents.

1. Cement replacement shall not exceed a percentage level that has been shown by experience on other projects to exhibit satisfactory performance using materials from identical sources as proposed for this project. As an alternate, trial concrete batches can be performed to identify mix designs that maximize cement replacement while meeting strength requirements per ACI 318 Section 26.4 and finishability criteria.

2. The use of fly ash or slag in architecturally exposed structural concrete shall be coordinated with the Architect, Engineer of Record, and Contractor.

3. If fly ash is used, it must be at a minimum replacement percentage of 15%.

4. Overall replacement percentages with combined fly ash and slag shall not exceed the maximum identified with slag or be less than the minimum identified with fly ash for each type of element. In addition, the replacement percentage of fly ash within the combined mix shall not exceed the maximum identified with fly ash alone.

5. Replacement percentages exceeding the maximum may be permitted at the discretion of the Architect, Engineer of Record, and Contractor.

6. For concrete identified on the drawings as being subject to Exposure Class F3, the maximum amount of supplementary cementitious materials shall not exceed the limits noted in Table 4.2.2.7.b.2 “Maximum cementitious materials requirements for concrete exposed to deicing chemicals” of ACI 301.

7. Except for Mass Concrete, the Contractor may submit for approval a revised mix design with lower supplementary cementitious material percentages than herein specified should finishability or other issues arise due to changing weather conditions.

G. Aggregate: Comply with the following special requirements:

1. For exposed concrete, provide aggregates from a single source.
2. For exposed surfaces subject to Exposure Class C1 or C2, do not use aggregates containing spalling-causing deleterious substances.

3. For slabs and other designated concrete, combined aggregate gradation shall be 8% - 18% for large top size aggregates (1 1/2 in.) or 8% - 22% for smaller top size aggregates (1 in. or 3/4 in.) retained on each sieve below the top size and above the No. 100. Deviations from this gradation may be allowed upon the approval of the Engineer subject to the following limitations:

   a. The percent retained on two adjacent sieves shall be not less than 5%.
   b. The percent retained on three adjacent sieves shall be not less than 8%
   c. If the percent retained on two adjacent sieves is less than 8%, the total percent retained on either of those sieves and the adjacent outside sieve shall be not less than 13 %

H. Admixtures:

1. Admixtures to be used in concrete shall be subject to the approval of the Engineer and District's Testing Laboratory and shall be used for the purpose intended by the manufacturer to produce concrete to meet the specified requirements.

2. Quantities of admixtures to be used shall be in strict accordance with the manufacturer’s instructions.

3. Air Content Requirements: For concrete subject to Exposure Class F1, F2 or F3 as noted on the drawings, use air-entrainment admixtures to provide concrete such that the air content at the point of placement shall conform to the requirements of ACI 301 Table 4.2.2.7.b “For Exposure Category F: Freezing and thawing exposures” within plus or minus 1.5%. Required air content levels may be reduced by 1.0 percent for concrete strengths above 5,000 PSI.

   a. Interior steel troweled surfaces shall not have more than 3% total air content.
   b. Surfaces scheduled to receive hardeners shall not have more than 3% total air content.

I. Adjustments of Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such mix design adjustments shall be provided at no additional cost to the District. Any adjustments in approved mix designs including changes in admixtures shall be submitted in writing with the specified Concrete Mix Design Submittal Form to the Engineer and District's Testing Laboratory for approval prior to field use.

J. Shrinkage: Concrete so identified on the drawings shall be proportioned for a maximum allowable unit shrinkage as noted on the drawings, measured at 28 days after curing in lime water as determined by ASTM C 157 (using air storage). Submit results of test for each class of applicable concrete after every 500 cubic yards placed.

K. Chloride Ion Content:
1. Unless noted otherwise, The maximum water soluble chloride ion concentration in hardened concrete measured at ages from 28 to 42 days contributed from all ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the limits specified in ACI 318-08 Table 4.3.1 depending on to which Corrosion Exposure Class (CO, C1 or C2) the concrete is subject as noted on the drawings. Water-soluble chloride ion tests shall conform to ASTM C 1218. One test shall be run for each class of concrete before the mix design submittal and each time a change is made to the mix design (such as change in aggregate type or source).

2. The Concrete Supplier shall certify in the Mix Design Submittal that the chloride ion content in all concrete mix designs used on the project does not exceed the limits stated above.

2.5 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94, "Ready Mixed Concrete" and this specification.

B. Concrete Fill at Stairs: Mix in proportions by volume of one part cement, two parts fine aggregate, one part coarse aggregate (3/8 inch), with as little water as possible to create a stiff, workable plastic mix.

2.6 SOURCE QUALITY CONTROL

A. Concrete Batch Plant Inspection: An initial batch plant inspection shall be made by the District’s Testing Laboratory prior to the start of concrete work. The scope of batch plant inspection shall include the following:

1. Inspection of Batch Plant Facilities: The Laboratory shall inspect batch plant facilities proposed for use in the work and report in writing inspection results to the Architect, Engineer, and District for approval. The inspection shall confirm the batch plant conforms to the standards set forth in ASTM C94 and can show proof of certification by the National Concrete Ready Mix Association. Inspection shall include:

   a. Batch Plant operations and equipment
   b. Truck mixers
   c. Scales
   d. Stockpile placement
   e. Material storage
   f. Admixture dispensers

2. Multiple Batch Plants: The Contractor shall reimburse the District for the costs accrued to the District’s Testing Laboratory for visits to more than 1 batch plant.

3. Waiver of Batch Plant Inspection

   a. Continuous batch plant inspection may be waived in accordance with CBC Section 1705A3.3.1 if the plant complies with ASTM C94 and has been...
certified by an agency acceptable to DSA to comply with the requirements of the National Ready Mix Concrete Association.

b. When batch plant inspection is waived, the following is required:
   (1) The District’s Testing Agency shall check the first batching at the start of concrete work and furnish mix proportions to the licensed Weighmaster.
   (2) Licensed Weighmaster shall identify material quantities and certify each load by a ticket.
   (3) The Project Inspector shall collect truck mix tickets with load identification and maintain a daily record of placement. Trucks without a load ticket identifying the mix shall be rejected. Copies of daily placement record shall be submitted to DSA.

c. At project closeout, the Weighmaster shall submit an affidavit to DSA certifying that all concrete supplied conforms to the proportions established by mix designs.

PART 3 - EXECUTION

3.1 SLUMP LIMIT

A. The slump, as measured in the field where concrete cylinders are taken, shall be within plus or minus 1 inch of the design slump noted on the approved mix design. Water may be added to the concrete in the field only to the extent that the prescribed water/cementitious ratio noted in the approved mix design is not exceeded.

3.2 VAPOR RETARDER INSTALLATION

A. Install vapor retarder in accordance with ASTM E 1643 and manufacturer’s instructions.

B. Lap all seams 6” and seal all joints in the field with the specified pressure sensitive tape. Heat-welded joints done in a shop prior to delivery is an acceptable method to minimize the number of field joints.

C. Seal all pipe penetrations through the vapor retarder with a boot made from the vapor retarder material and tape.

3.3 JOINTS IN CONCRETE

A. Construction Joints: Locate and install construction joints as indicated on the DSA approved drawings.

1. Keyways: Provide keyways with a depth of one tenth of the member thickness (1 1/2" minimum or as shown on the DSA approved drawings) in construction joints only where shown on the drawings.

2. Joint Construction: Unless noted otherwise on the DSA approved drawings, place construction joints in the center one third of suspended spans and grade beams and as shown on the DSA approved drawings for slabs-on-grade and walls unless shown otherwise. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection. Place joints perpendicular to main
reinforcement. Continue reinforcement across construction joints unless otherwise shown on the drawings. Dowels that cross construction joints shall be supported during concreting operations so as to remain parallel with the slab or wall surface and at right angles to the joint. Submit all construction joint locations as a shop drawing submittal.

3. **Joint Preparation:** The surfaces of horizontal construction joints shall be cleaned and roughened by exposing clean aggregate solidly embedded in mortar matrix.

4. **Waterstops:** Provide waterstops in construction joints as indicated on the Architectural and Structural Drawings. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

B. **Contraction Joints in Slabs-on-Ground and Unbonded Topping Slabs:** Maximum joint spacing shall be 36 times the slab thickness or 20 feet, whichever is less and at a minimum on column lines unless otherwise noted on the drawings. Use one of the two following methods (sawed or formed) to create the joints. Do not use the formed joint in areas subject to vehicular traffic.

1. **Sawed Joints**
   a. **Primary Method:** Early-Entry, dry-cut method, by Soff-Cut International, Corona, CA (800) 776-3328. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within 1 to 4 hours, depending on air temperature, after final finish as soon as the concrete surface is firm enough to not be torn or damaged by the blade at each saw cut location. Use 1/8 inch thick blade, cutting 1 1/4” inch into the slab.
   
   b. **Optional Method** (where Soff-Cut System method equipment is not available, subject to limitations): This method may not be used when there is no dowel passing through the contraction joint. Use a conventional saw to cut joints within 4 to 12 hours after finishing as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/8 inch thick blade, cutting to a depth of 1/4 of the slab thickness but not less than 1 inch. Cut to a depth of 1/3 slab thickness for slabs reinforced with steel fibers.

2. **Formed Joints:** Form contraction joints by inserting premolded plastic hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. The depth is to be 1/4 the slab thickness, but not less than 1 inch. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

3. **Joint Filler:** Provide in both contraction and saw-cut construction joints when specified.
   a. Remove dirt and debris from the joint by vacuuming immediately prior to filling joint. Clean the joint of curing compounds and sealers.
b. Filler material shall be applied to the joints when the building is under permanent temperature control, but no less than 90 days after slab construction.

c. Follow the manufacturer’s recommended procedure for installing filler material. The joint filler must be flush with the adjacent concrete. A concave profile on the top of the joint filler is unacceptable and will be grounds for removal and replacement.

4. The Contractor shall protect the joints from damage caused by wheeled traffic or other sources during construction until a joint-filler material (if specified) has been installed.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto unless directed otherwise by these specifications. Install reglets to receive top edge of foundation sheet waterproofing where specified by the Architect, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles and other conditions.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

C. Do not install sleeves in concrete slabs, pier caps, footings or walls except where shown on the structural drawings or approved by the Architect, Engineer and DSA.

D. Securely fasten embedded plates, angles, anchor rods and other items to be built into the concrete to the formwork or hold in place with templates. Insertion of these items into concrete after casting is prohibited.

3.5 CONCRETE PLACEMENT

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Concrete Batch Trip Tickets: The Inspector of Record shall collect and retain concrete batch trip tickets and maintain a daily record of placement. Compressive strength, slump, air content, and temperature tests shall be identified by reference to a particular trip ticket. Tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mixture. The Inspector of Record and Testing Laboratory shall immediately notify the Architect/Engineer and Contractor of tickets not meeting the criteria specified.
C. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

D. Comply with ACI 301 and as herein specified.

1. Place concrete in accordance with ACI 318 Section 26.5.2.

2. Concrete Temperature: The maximum acceptable concrete temperature at the truck discharge point shall be 90°F.

3. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. Spread concrete using short-handled, square-ended shovels, or come-alongs.

4. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

5. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use internal vibrators of the largest size and power that can properly be used in the work as described in the table entitled “Range of characteristics, performance, and applications of internal vibrators” found in ACI 301.

6. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

7. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs. Do not place concrete over columns and walls until concrete in columns and walls is no longer plastic and has been in place at least one hour.

8. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners of forms, eliminating air and stone pockets that may cause honeycombing, pitting, or planes of weakness.

9. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats or darbies to smooth surface free of humps or hollows.
before excess moisture or bleedwater appears on the surface. Do not disturb slab surfaces prior to beginning finishing operations.

10. Maintain reinforcing in proper position during concrete placement operations.

11. Placing Concrete by Pump: If concrete is placed by using a pump, the grout used for pump priming must not become a part of the completed structure unless an engineered grout design mix and grout location are approved in advance by the Engineer.

E. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect design mixture number).

2. Environmental condition limits shall be as follows unless appropriate provisions in concrete practices have been made for cold or hot weather:
   a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for three consecutive days unless the temperature rose about 50°F for at least one-half of any of those 24 hour periods.
   b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 pounds per square foot per hour or less as determined by the figure “NRMCA Nomograph for Estimating Evaporation Rate on the Basis of Menzel Formula” in Appendix A of ACI 305.1.
   c. Concrete may be placed at other environmental condition ranges only with the approval of the job inspector for the Testing Laboratory or other duly appointed representative.

3. Concrete with temperatures exceeding 95°F.

4. Air contents outside the limits specified in the design mixtures.

5. Slumps outside the limits specified.

6. Water added to the mix that exceeds the maximum allowed water-to-cementitious material ratio.

7. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes and it shall be discharged before the drum has revolved 300 revolutions, unless approved by the Testing Laboratory job inspector or other duly appointed representative.

3.6 FINISH OF FORMED SURFACES

A. General: Formed surfaces shall have the finishes as described below and as shown on the drawings after formwork is removed and repairs made.

B. Definitions and Finish Requirements
1. Surface Finish 1.0 (SF-1.0):
   a. No formwork facing material is specified
   b. Patch voids larger than 1-1/2 in. wide or 1/2 in. deep
   c. Remove projections larger than 1.0 inch.
   d. Provide surface tolerance Class D as specified in ACI 117
   e. Tie holes need not be patched

2. Surface Finish 1.1 (SF-1.1):
   a. No formwork facing material is specified
   b. Patch voids larger than 1 in. wide or 1/2 in. deep
   c. Remove projections larger than 1/2 inch.
   d. Provide surface tolerance Class C as specified in ACI 117
   e. Tie holes need not be patched

3. Surface Finish 2.0 (SF-2.0):
   a. Provide specified formwork-facing material
   b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
   c. Patch tie holes
   d. Remove projections larger than 1/4 in.
   e. Provide surface tolerance Class B as specified in ACI 117
   f. Provide mock-up of concrete surface appearance.

4. Surface Finish 2.2 (SF-2.2):
   a. Provide specified formwork-facing material
   b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
   c. Patch tie holes
   d. Remove projections larger than 1/4 in.
   e. Provide surface tolerance Class B as specified in ACI 117

5. Surface Finish 2.3 (SF-2.3):
   a. No formwork-facing material is specified
   b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
   c. Patch tie holes
   d. Remove projections larger than 1/4 in.
   e. Provide surface tolerance Class B as specified in ACI 117

C. Standard Finish: Provide SF-1.0 on all concrete surfaces not exposed to view in the final condition unless otherwise specified.

D. Exposed Finishes: Provide SF-2.0 on all concrete surfaces exposed to view in final condition unless otherwise specified.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture
matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.7 MONOLITHIC SLAB FINISHES

Place, consolidate, strike off, and level concrete, eliminating high spots and low spots, before proceeding with any other finish operation. Do not add water to the surface of the concrete during finishing operation.

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerance specified below. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using a hand float, a bladed power float equipped with float shoes, or a powered disk float, when the bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit the operation. Check and level surface plane to a tolerance as specified below. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system. After floating, begin first trowel finish operation by hand or power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface to a tolerance as specified below. Grind smooth surface defects which would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply initial trowel finish as specified above, then immediately follow with slightly scarifying surface by fine brooming.

E. Slip-Resistive Broom Finish: Apply slip-resistive broom finish to ramps less than 6% slope, exterior concrete platforms, steps and ramps and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Penetrating Sealer Finish: Apply a chloride-and-water-repelling-penetrating-sealer finish to surfaces as described below and where indicated on the drawings. Apply liquid penetrating sealer after complete curing and drying of the concrete surface. Apply proprietary sealers in strict accordance with manufacturer’s printed instructions. The Contractor shall verify the compatibility of the sealer product with the paint used to stripe
parking decks and coordinate the sequencing of the sealing and striping operations. Apply to the following surfaces:

1. **Top surfaces of exposed exterior walkways**

**G. Slip-Resistive Aggregate Finish:** Apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps and elsewhere as indicated on the Architect's or Structural Drawings.

After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened slip-resistive aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose slip-resistive aggregate.

**H. Finish of Top of Spread and Continuous Footings:**

1. **Top Surface below Finished Slab:** The top of the footing or mat shall be screeded level and smooth with a flatness F-number, F_{15} (overall), F_{10} (minimum local) and a levelness F-number, F_{L12} (overall), F_{L10} (minimum local).

2. **Top Surface as Finished Slab:** The top surface of a footing or mat that is to serve as the finished slab in the building shall be leveled, cured, and surface prepared as specified for the finished floor construction appropriate to the space usage as defined in the Architectural Drawings.

### 3.8 CONCRETE FINISH MEASUREMENT AND TOLERANCES

**A. Testing Procedure:** ASTM E 1155

**B. Tolerance on Floor Elevations:** Construction tolerance on absolute floor elevation from the specified elevation as shown on the drawings shall be as specified below, taken from ACI 117:

1. **Slab-on-Grade Construction** - ± 3/4".

2. **Top surfaces of formed slabs measured prior to removal of supporting shores** - ± 3/4".

3. **Top surfaces of all other slabs** - ± 3/4".

**C. Random Traffic Floor Finish Tolerances:**

1. Specified overall values for flatness (SOF_{F}) and levelness (SOF_{L}) shall conform to the values listed below for the floor surface classification noted for each slab category noted.
### Floor Surface Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>SOF&lt;sub&gt;F&lt;/sub&gt;</th>
<th>SOF&lt;sub&gt;L&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Moderately Flat</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Flat</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>Very Flat</td>
<td>45</td>
<td>35</td>
</tr>
<tr>
<td>Super Flat</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

2. Minimum local values for flatness (MLF<sub>F</sub>) and levelness (MLF<sub>L</sub>) shall equal 3/5 of the SOF<sub>F</sub> and SOF<sub>L</sub> values, respectively, unless noted otherwise. The MLF<sub>F</sub> and MLF<sub>L</sub> values shall apply to the minimum areas bounded by the column lines and half-column lines, or the minimum areas bounded by the construction and contraction joints, whichever are the smaller areas.

3. The SOF<sub>L</sub> and MFL<sub>L</sub> tolerance values shall apply only to level slabs-on-ground or to level, uncambered suspended slabs that are shored such that it cannot deflect from the time the floor is placed to the time it is measured.

4. Slabs specified to slope shall have a tolerance from the specified slope of 1/4" in 10 feet at any point.

### D. Construction Requirements to Achieve Specified Floor Finish Tolerances:

1. Forms shall be properly leveled, in good condition and securely anchored including special attention to ends and transitions.

2. Bearing surfaces for straightedges such as form edges or previously poured slabs shall be kept clean of laitance, sand, gravel, or other foreign elements.

3. Screeds shall be maintained in good condition with true round rolling wheels and level cutting edges. The use of optical sighting equipment such as lasers is recommended for checking levelness and straightness. The Contractor shall promptly adjust or replace equipment when test results indicate substandard work.

4. Highway straightedges are recommended for use in lieu of bullfloats for all slab placement and finishing operations.

### E. Contractor Responsibility for Concrete Floor Finish Requirements:

Floor finish requirements shown below (flatness and levelness tolerances) are minimum requirements that apply unless stricter requirements are contained in instructions for installation of applied floor products in which case the Contractor is responsible for attaining the values prescribed by the manufacturer of such products.

### F. Concrete Floor Finish Tolerance for Slab-on-Grade Construction:

1. Concrete Placement: Concrete shall be placed and screeded to predetermined marks set to elevations prescribed on the drawings.

2. Finish Tolerances of Random Traffic Floor Surfaces:
a. Slabs in nonpublic areas, mechanical rooms, surfaces to receive raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional

b. Carpeted Areas: Moderately Flat

c. Exposed slabs in public spaces, slabs to receive thin-set flooring: Flat

G. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:

1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:

a. The composite overall values of $F_F$ or $F_L$ of the entire floor installation measure less than specified values.

b. Any individual test section measures less than the specified absolute minimum $F_F$ or $F_L$ value.

2. Modification of Existing Surface:

a. If, in the opinion of the Architect/Engineer or District's Representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately undertake the approved repair method.

b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair and time to affect the repair.

c. Repair method(s), at the sole discretion of the Architect/Engineer or District's Representative, may include grinding (floor stoning), planing, retopping with self leveling underlayment compound or repair topping, or any combination of the above.

d. The Architect/Engineer or District's Representative maintains the right to require a test repair section using the approved method of repair for review and approval to demonstrate a satisfactory end product. If, in the opinion of the Architect/Engineer or District's Representative, the repair is not satisfactory an alternate method of repair shall be submitted or the defective area shall be replaced.

e. The judgment of the Architect/Engineer or District's Representative on the appropriateness of a repair method and its ability to achieve the desired end product shall be final.

f. All repair work shall be performed at no additional cost to the District and with no extension to the construction schedule.

3. Removal and Replacement:

a. If, in the opinion of the Architect/Engineer or District's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately commence to remove and replace the defective work.

b. Replacement section boundaries shall be made to coincide with the test section boundaries as previously defined.
c. Sections requiring replacement shall be removed by sawcutting along the section boundary lines to provide a neat clean joint between new replacement floor and existing floor.

d. The new section shall be reinforced the same as the removed section and dowelled into the existing floor as required by the Engineer. No existing removed reinforcing steel may be used. All reinforcing steel shall be new steel.

e. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or District's Representative.

f. The judgment of the Architect/Engineer or District's Representative on the need for replacement shall be final.

g. All replacement work shall be performed at no additional cost to the District and with no extension to the construction schedule.

3.9 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete. Limit moisture loss to a maximum of 0.05 lb./sq. ft – hr for concrete containing silica fume and 0.2 lb./sq. ft. - hr for all other concrete before and during finishing operations. If using an evaporation retarder, apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be 7 days for all concrete except high early strength concrete which shall be cured for 3 days minimum.

3. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period.

B. Curing Formed Surfaces: Where wooden forms are used, cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by one or a combination of the methods specified below, as applicable.

1. Sides of Beams and Slabs: Moist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

2. Sides of Exterior Retaining Walls: Moist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, type 1, class A or B for method 3.
C. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping and other flat surfaces by one or a combination of the methods specified below, as applicable. The Contractor shall choose a curing method that is compatible with the requirements for subsequent material usage on the concrete surface.

1. Floors in Non-Public spaces that are left exposed to view and not receiving sealers or hardeners, floors involved in under-floor air distribution systems: Apply one coat of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, type 1, Class A or B in accordance with method 3 as specified below.

2. All Other Surfaces: Cure using methods 1, 2 or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

D. Curing Methods:

1. Method 1 - Moisture Curing: Provide moisture curing by one of the following methods:
   a. Keep concrete surface continuously wet by covering with water.
   b. Continuous water-fog spray.
   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Method 2 - Moisture-Retaining Cover Curing: Provide moisture-retaining cover curing as follows:

   Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Water may be added to concrete surface to prevent drying before the cover is installed, but the surface shall not be flooded with water if a non-absorptive cover is used.

3. Method 3 – Curing or Curing and Sealing Compound: Provide curing, curing/hardener, liquid membrane-forming curing, or curing and sealing compound as follows:

   Apply specified compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Do not allow to puddle. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period. Apply second coat for sealing 2 to 3 hours after the first coat was applied.

   Do not use membrane-forming curing and sealing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor
hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glued-down carpet, vinyl composition tile, linoleum, sheet vinyl, rubber, athletic flooring, synthetic turf, or wood), paint or other coatings and finish materials. Dissipating resin type cures are acceptable in these locations.

3.10 HOT WEATHER CONCRETING

A. Definition:

1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. If conditions cause an evaporation rate of 0.2 pounds per square foot per hour or greater as calculated by the figure “NRMCA Nomograph for Estimating Evaporation Rate on the Basis of Menzel Formula” in Appendix A of ACI 305.1, then precautions shall be taken to prevent plastic shrinkage cracks from occurring.

B. Specification: Follow hot weather concreting practices specified below when required to limit the concrete temperature at the truck discharge point to the stated maximum acceptable temperature.

C. Records: Under hot weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature at truck discharge and general weather conditions.

D. Hot Weather Concreting Requirements: The following items, all or in part as required, shall be followed to limit the concrete temperature to the stated maximum acceptable temperature and to minimize the possibility of plastic shrinkage cracks from developing.

1. Design the concrete mixes specifically for hot weather conditions replacing some cement with fly ash or other pozzolan and using a water reducing retarding admixture (ASTM C 494 Type D).

2. Use the largest size and amount of coarse aggregate compatible with the job.

3. Use sunshades and/or windbreaks.

4. Delay construction of indoor slabs-on-grade until the walls and roof are constructed.

5. Cool and shade aggregate stockpiles.

6. Use ice as part of the mixing water or cool the water with liquid nitrogen.

7. Limit the number of revolutions at mixing speed to 125 maximum.

8. Reduce time between mixing and placing as much as possible.

9. Do not add water to ready-mixed concrete at the job site unless it is part of the amount required initially for the specified water-cement ratio and the specified slump.
10. Schedule concrete placement for early morning, late afternoon, or night.
11. Have all forms, equipment and workers ready to receive and handle concrete.
12. Maintain one standby vibrator for every three vibrators used.
13. Keep all equipment and material cool by spraying with water including exteriors of forms, reinforcing steel, subgrade, chutes, conveyors, pump lines, tremies, and buggies.
14. Protect slab concrete at all stages against undue evaporation by applying a fog spray or mist above the surface or applying a monomolecular film. Where high temperatures and/or placing conditions dictate, use water-reducing retarding admixture (Type D) in lieu of the water-reducing admixture (Type A) as directed by the District's Testing Laboratory.
15. Provide continuous curing, preferably with water, during the first 24 hours using wet burlap, cotton mats, continuous spray mist, or by applying a curing compound meeting ASTM C 1315. Continue curing for 3 days minimum.
16. Cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature immediately before placement of concrete.
17. As soon as possible, loosen forms and run water down the inside. When forms are removed, provide a wet cover to newly exposed surfaces.

3.11 COLD WEATHER CONCRETING

A. Limits:
1. Concrete shall not be placed when the outside air temperature is 40°F or less.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor rods for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Installation of Adhesive Anchors Using Injectable Epoxy or Adhesive: The District’s Testing Laboratory representative or the project IOR shall provide special inspection of the installation of all adhesive anchors. A representative of the adhesive manufacturer shall be
present for the first day that adhesive anchors are installed. After drilling the hole to the
diameter and depth recommended by the manufacturer, clean the hole with a wire or nylon
brush. Blow the dust out of the hole using compressed air with a nozzle that reaches to the
bottom of the hole. When using adhesive from a new pack, the adhesive that is discharged
from the mixing nozzle should be a uniform gray color before any adhesive is installed in
the hole. Fill the hole with adhesive starting from the very bottom of the hole until the hole
is about 2/3 full. Do not leave an air pocket at the bottom of the hole. Insert the anchor rod
or dowel by slowly twisting it into the hole.

3.13 CONCRETE SURFACE REPAIRS

A. Definition - Defective Areas:

1. Formed Surfaces: Concrete surfaces requiring repairs shall include all cracks in
   excess of 0.01" and any other defects that affect the durability or structural integrity
   of the concrete. Voids, including honeycombing and rock pockets, and tie holes
   shall be repaired as required by the specified Surface Finish.

2. Unformed Surfaces: Concrete surfaces requiring repair shall include all surface
defects such as crazing, cracks in excess of 0.01" wide or cracks which penetrate
to reinforcement or through the member, popouts, spalling and honeycombs.

B. Classification:

1. Structural Concrete Repair: Major defective areas in concrete members that are
   load carrying (such as shear walls, beams, joists and slabs), are highly stressed,
   and are vital to the structural integrity of the structure shall require structural
   repairs. Structural concrete repairs shall be made using a two-part epoxy bonder,
   epoxy mortar or specified polymer repair mortar. The Engineer shall determine
   the locations of required structural concrete repairs.

2. Cosmetic Concrete Repair: Defective areas in concrete members that are non-load
   carrying and minor defective areas in load carrying concrete members shall require
   cosmetic concrete repair when exposed to view and not covered up by architectural
   finishes. Cosmetic concrete repairs may be made using a polymer repair mortar
   and compatible bonding agent. The Architect/Engineer shall determine the
   locations of required cosmetic concrete repairs. Stains and other discolorations
   that cannot be removed by cleaning and are exposed to view will require cosmetic
   repair. Cosmetic concrete repair in exposed-to-view surfaces will require
   Architect's approval prior to patching operation.

3. Slab Repairs: High and low areas in concrete slabs shall be repaired by removing
   and replacing defective slab areas unless an alternate method, such as grinding
   and/or filling with self-leveling underlayment compound or repair mortar is
   approved by the Architect/Engineer. Repair of slab spalls and other surface defects
   shall be made using epoxy products as specified above and as determined by the
   Engineer. The high strength flowing repair mortar may be used for areas greater
   than 1 inch in depth.
3.14 FIELD QUALITY ASSURANCE

A. The District will engage a special inspector (IOR) and qualified testing and inspection agency (the District’s Testing Laboratory) to perform field tests and inspections and prepare test reports.

B. Special Inspections: The District’s Testing Laboratory or a separate agency shall serve as a Special Inspector to provide Special Inspection services for the items listed below. The scope of such services for each item shall be as defined in the 2016 CBC. These inspections are mandatory for conformance to the legal requirements of the building code and shall be in addition to the inspections and tests otherwise defined in this specification.

1. Verification of use of required design mixture
2. Concrete placement, including conveying and depositing
3. Curing procedures and maintenance of curing temperatures
4. Verification of concrete strength before removal of shores and forms from beams and slabs.
5. Anchor rods, bolts and other embeds installed in concrete.

C. Qualifications of Special Inspector (IOR): The IOR shall be a qualified person who is approved by DSA.

D. Duties and Responsibilities of the Special Inspector:

1. The IOR shall observe the work assigned to ascertain that, to the best of his/her knowledge, it is in conformance with the approved design drawings and specifications.
2. The IOR shall furnish inspection reports to DSA, the Architect/Engineer, and the District. All discrepancies shall be brought to the immediate attention of the Architect/Engineer, Contractor, and District. A report that the corrected work has been inspected shall be sent to DSA, the Architect/Engineer, and the District.
3. The IOR shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector’s knowledge, in conformance to the approved plans and specifications and the applicable workmanship provisions of the building code.

E. Qualifications Of Testing Laboratory

1. The Testing Laboratory shall meet the basic requirements of ASTM E329 and shall submit to the District, Architect, and Engineer evidence of current accreditation from the American Association for Laboratory Accreditation, the AASHTO Accreditation Program or the “NIST” National Voluntary Laboratory Accreditation Program.
2. The Testing Laboratory shall be an Approved Agency by the Building Official of the city wherein the project is located to perform Special Inspections and other tests and inspections as outlined in the applicable building code.

3. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

F. Authorities And Duties Of The Laboratory

1. Attending Preconstruction Conferences: The District’s Testing Laboratory shall receive from the District and review the project plans and specifications with the Architect and Engineer as soon as possible prior to the start of construction. The Laboratory shall attend preconstruction conferences with the Architect, Engineer, Project Manager, General Contractor, and Material Suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule and shall participate in such conferences throughout the course of the project.

2. Cost Proposal: The Testing Laboratory's proposal to the District shall contain unit price stipulations for specified tests and inspections and on an hourly basis for personnel. A total estimated price shall also be submitted.

3. Cooperation with Design Team: The Laboratory shall cooperate with the Architect, Engineer, and Contractor and provide qualified personnel promptly on notice.

4. The Laboratory shall perform the required inspections, sampling, and testing of materials as specified under each section and observe methods of construction for compliance with the requirements of the Contract Documents and the applicable building code.

5. Inspections Required by Government Agencies: The Testing Laboratory shall perform inspections and submit reports and certifications as required by government agencies having jurisdiction over the aspects of the project covered by this specification.

6. Notification of Deficiencies in the Work: The Laboratory shall notify the Architect, Engineer, and Contractor within 24 hours of discovery by telephone or e-mail, and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.

7. Reports:

   a. Information on Reports: The Laboratory shall submit copies of reports of inspections and tests promptly and directly to the parties named below. The reports shall contain at least the following information:
      (1) Project Name
      (2) Date report issued
(3) Testing Laboratory name and address
(4) Name and signature of inspector
(5) Date of inspection and sampling
(6) Date of test
(7) Identification of product and Specification section
(8) Location in the project
(9) Identification of inspection or test
(10) Record of weather conditions and temperature (if applicable)
(11) Results of test regarding compliance with Contract Documents

b. Copies: The Laboratory shall send signed copies of test and inspection reports to the following parties:
   (1) 1 copies to the District or his representative
   (2) 1 copies to the General Contractor
   (3) 1 copy to the Architect
   (4) 1 copy to the Engineer of responsibility

8. Certification: Upon completion of the job, the Laboratory shall furnish to the District, Architect, and Engineer of Record, a statement signed by a licensed professional engineer that, to the best of their knowledge, required tests and inspections were made in accordance with the requirements of the Contract Documents.

9. Accounting: The Testing Laboratory shall be responsible for separating and billing costs attributed to the District and costs attributed to the Contractor.

10. Monitoring Product and Material Certifications: The Testing Laboratory shall be responsible for monitoring the submittals of product and material certifications from manufacturers and suppliers as specified in the Specifications and shall report to the District, Architect, and Engineer when those submittals are not made in a timely manner.

11. Limitations of Authority: The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors.

G. Concrete Mix Designs: The District’s Testing Laboratory shall review the submitted mix designs for conformance to the specifications and for suitability for use in the project. The Testing Laboratory shall attend the Mix Design Conference and the Pre-Concrete Conference as noted in the Cast-in-Place Concrete Specification.

H. Job Site Inspection: The scope of the work to be performed by the inspector on the jobsite shall be as follows:

1. Prior to Concrete Placing
   a. Spread Footings
      (1) Verify footing dimension.
      (2) Verify top of footing elevation.
(3) Verify that forms are plumb and straight, braced against movement, and lubricated for removal.
(4) Inspect reinforcement per REINFORCING STEEL section.

b. Drilled Piers
(1) Verify pier dimension.
(2) Verify bottom and top of pier elevations.
(3) Verify that pier form at top is plumb and straight, braced against movement, and lubricated for removal.
(4) Inspect pier hole to verify hole is clean and dry.
(5) Inspect reinforcement per REINFORCING STEEL section.

c. Slab-on-Grade
(1) Verify that moisture retarder is provided, is lapped properly, and is not torn or punctured.
(2) Verify formwork at turndowns and slab edges is plumb and straight, braced against movement and lubricated for removal.
(3) Inspect reinforcement per REINFORCING STEEL section.
(4) Verify there is no standing water or debris in pour area.

d. Curbs and Housekeeping Pads
(1) Verify that forms are plumb and straight, braced against movement, lubricated for removal, and conform to approved shop drawings.
(2) Verify proper dimensions, elevation and orientation.
(3) Inspect reinforcement per REINFORCING STEEL section.
(4) Verify that debris is removed.

2. On-Site Concrete Material Testing and Inspection

a. Verify that the Contractor is following appropriate concreting practices consistent with any extreme environmental conditions at the point of placement in the structure as defined below.

b. Inspect concrete upon arrival to verify that the proper concrete mix number, type of concrete, concrete strength, and that it is meeting job specifications, is being placed at the proper location. Report concrete not meeting the specified requirements and immediately notify the Contractor, Batch Plant Inspector, Architect, Engineer, and District.

c. Inspect plastic concrete upon arrival at the jobsite to verify proper batching. Observe mix consistency and adding of water as required to achieve target slumps in mix designs. Record the amount of water added and note if it exceeds that allowed in the mix design. The responsibility for adding water to trucks at the job site shall rest only with the Contractor's designated representative. The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.

d. Obtain concrete test cylinders as specified below.

e. Perform tests to determine slump, concrete temperature, unit weight, and air entrainment as specified below. The slump tests shall be made on concrete taken from the same location from which the concrete for the test cylinders is obtained.

f. Record information for concrete test reports as specified below.

g. Verify that concrete being placed meets job Specifications. Report concrete not meeting the specified requirements and immediately notify
h. Pick up and transport to Laboratory, cylinders cast the previous day.

3. During concrete placing, provide continuous monitoring to:
   a. Verify that the concrete is not over 90 minutes old at the time of placement.
   b. Verify that Hot-Weather techniques are being applied as required.
   c. Verify that concrete deposited is uniform and that vertical drop does not exceed six feet and is not permitted to drop freely over reinforcement causing segregation.
   d. Verify that there are no cold joints.
   e. Verify that the concrete is properly vibrated.
   f. Verify that the finishing of the concrete surface is done according to specifications.
   g. Verify that sawcut control joints on slab-on-grades are cut within 12 hours of placement.
   h. Verify that the formwork has remained stable during the concreting operation.
   i. Inspect anchor rods, bolts and other items embedded in concrete prior to and during concrete placement for proper grade, size and length and verification they have been properly installed to the specified embedment.

4. Post-Installed Anchors in Concrete: Provide inspection of post-installed anchor installations at the frequency noted in the specifications and in accordance with the published, currently valid, Evaluation Service Report (ESR) for each anchor product.
   a. Continuous Inspection: Unless noted otherwise all Post-Installed Anchors shall have Continuous Inspection. Verify each installation of post-installed anchors in concrete in accordance with the requirements stated below for each type of anchor.
   b. All Post-Installed Anchors: Verify that the anchor is installed in accordance with manufacturer’s printed installation instructions as well as the following design requirements:
      (1) concrete type, concrete strength and concrete thickness are in accordance with design drawings
      (2) anchor manufacturer and product is in accordance with design drawings or approved substitution
      (3) anchor diameter, length and installed embedment depth
      (4) drill bit type and diameter
      (5) anchor edge distance and spacing
      (6) hole diameter and depth
      (7) hole cleaning procedure and cleanliness
      (8) anchor maximum tightening torque
   c. Adhesive Anchors: In addition to the requirements for All Post-Installed Anchors, verify following design requirements:
      (1) adhesive identification and expiration date
      (2) The installation of all adhesive anchors subject to sustained direct tension loads or installed in a upwardly inclined condition as noted on the drawings shall be continuously inspected.
d. Periodic Inspection: Where Periodic Inspection is specified, verify initial installation of post-installed anchors in concrete for each individual installer with each individual anchor product in accordance with the requirements stated below for each type of anchor. Periodically inspect anchor installation after the initial verification.

5. In-situ Concrete Strength Verification: The District’s Testing Laboratory shall verify that the concrete has reached the required minimum strength before form removal by evaluating the specified tests.
   a. If concrete strength for form stripping is to be determined using field-cured cylinders, one additional cylinder per set will be required for formed slab and pan joist floors for the purpose of evaluating the concrete strength at the time of form stripping. This cylinder shall be stored on the floor where form removal is to occur under the same exposure conditions as the floor concrete. The cylinder shall be cured under field conditions in accordance with ASTM C31. Field cured test cylinders shall be molded at the same time and from the same samples as Laboratory cured test specimens. The cylinder shall be broken at the time of form removal as directed by the Contractor. The Contractor shall reimburse the District for the cost of making and testing these cylinders.
   b. If concrete strength for form stripping is to be determined using the Maturity Method, the District’s Testing Laboratory shall verify that the requirements of ASTM C 1074 are being followed and that the proper criteria for determining concrete strength by this method has been established and is being followed.

6. After Concrete Floor Placing and Finishing
   a. Verify that the curing process is according to specifications and that any curing compound used is applied in accordance with manufacturer’s recommendations.

7. The job site inspector shall report any irregularities that occur in the concrete at the job site or test results to the Contractor, Architect, District, and Engineer.

I. Concrete Test Cylinders: The District’s Testing Laboratory shall cast and test concrete test cylinders as described below.

1. Cylinder Casting and Testing: Cylinders for strength tests shall be casted and Laboratory cured in accordance with ASTM C31 and tested in accordance with ASTM C39. Cylinders may be either 6” in diameter by 12” or 4” in diameter by 8”, however, the diameter of the cylinder shall be at least three times the nominal maximum size of the coarse aggregate in the mix tested. All of the cylinders for each class of concrete shall be of the same dimension for all sets of that class.

2. Field Samples: Field samples for strength tests shall be taken in accordance with ASTM C172.
3. **Frequency of Testing:** Each set of test cylinders shall consist of a minimum of four standard test cylinders. A set of test cylinders shall be made according to the following minimum frequency guidelines:

   a. One set for each class of concrete taken not less than once a day.
   b. Spread Footings: One set for each 50 cubic yards or fraction thereof.
   c. Floors: One set for each 50 cubic yards or fraction thereof but not less than one set for each 2000 square foot of floor area.
   d. All Other Concrete: A minimum of one set for each 50 cubic yards or fraction thereof.
   e. No more than one set of cylinders at a time shall be made from any single truck.
   f. If the total volume of concrete is such that the frequency of testing as specified above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
   g. The above frequencies assume that one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.

4. **The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded.**

5. **For concrete specified on the drawings to reach the required strength at 28 days, break one cylinder of the set at seven days, two 6” by 12” cylinders or three 4” by 8” cylinders at 28 days, and one kept in reserve for testing at the Engineers direction.**

6. **Cylinder Storage Box:** The Contractor shall be responsible for providing a protected concrete cylinder wooden storage box at a point on the job site mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory. The box shall be constructed and equipped to maintain the environment specified for initial curing in ASTM C31.

7. **Transporting Cylinders:** The District’s Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders including loss of moisture, freezing temperatures or jarring.

8. **Information on Concrete Test Reports:** The District’s Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:

   a. Truck number and ticket number
   b. Concrete Batch Plant
   c. Mix design number
   d. Accurate location of pour in the structure
   e. Strength requirement
   f. Date cylinders made and broken
   g. Technician making cylinders
   h. Concrete temperature at placing
i. Air temperature at point of placement in the structure
j. Amount of water added to the truck at the batch plant and at the site and whether or not it exceeds the amount allowed by the mix design
k. Slump
l. Unit weight
m. Air content
n. Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be flagged if either cylinder fails to meet Specification requirements.

9. Standards for Tests of Concrete:

a. Slump Tests: Slump Tests (ASTM C143) shall be made at the beginning of concrete placement for each batch plant and for each set of test cylinders made. The slump test shall be made from concrete taken from the end of the concrete truck chute. The concrete shall be considered acceptable if the slump is within plus or minus 1 inch of the slump noted on the mix design submittal form for that class of concrete.

b. Air Entrainment: Air entrainment tests (ASTM C231 or C173, C173 only for lightweight concrete) shall be made at the same time slump tests are made as cited above.

c. Concrete Temperature: Concrete temperature at placement shall be measured (ASTM C1064) at the same time slump tests are made as cited above.

d. Unit Weight Test: ASTM C138

10. Evaluation and Acceptance of Concrete:

a. Strength Test: A strength test shall be defined as the average strength of two cylinder breaks from each set of cylinders tested at the time indicated above.

b. Quality Control Charts and Logs: The District’s Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:

1. Number of strength tests made to date.
2. Strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.
3. Number of tests under specified strength.
4. A histogram plotting the number of strength test cylinders versus compressive strength.
5. Quality control chart plotting compressive strength test results for each test.
6. Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.
7. Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.
c. Acceptance Criteria: The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:

(1) The average of all sets of three consecutive strength tests equal or exceed the required f'c.

(2) No individual strength test falls below the required f'c by more than the greater of 10% of f'c or 500 PSI.

d. If either of the above requirements is not met, the Testing Laboratory shall immediately notify the Engineer by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.

J. Investigation of Low Strength Concrete Test Results:

1. Cost of Investigations for Low Strength Concrete: The Contractor shall reimburse the District for the costs of investigations of low strength concrete, as defined above.

2. Scope of Investigations: See Specification Section 03300, Cast-In-Place Concrete, for the investigations that may be required by the Engineer. The District’s Testing Laboratory will conduct these investigations.

K. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect mix design number).

2. Environmental Conditions: Environmental condition limits shall be as follows unless appropriate provisions in concreting practices have been made for cold or hot weather:

   a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for 3 consecutive days unless the temperature rose above 50°F for at least one-half of any of those 24 hour periods.

   b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 lb./sq. ft./hr. or less as determined by Figure 2.1.5 in ACI 305R-91.

Concrete may be placed at other environmental condition ranges only with approval of the job inspector for the District’s Testing Laboratory or other duly appointed representative.

3. Concrete with temperatures exceeding 95°F shall not be placed in the structure.

4. Air contents outside the limits specified in the mix designs.

5. Slumps outside the limits specified.
6. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes unless approved by the Laboratory job inspector or other duly appointed representative.

END OF SECTION
Example Concrete Mix Design
Submittal Form (Note 1)

I. Project Information
A. Name of Project: ______________________________
   B. City, State: ________________________________
C. General Contractor: ______________________________________________________________________
D. Concrete Supplier:
   1. Address: _____________________________________________________________________________
   2. Name to Contact: ____________________________ 3. Phone No.: _________ 4. Fax No.: ___________

II. Concrete Mix Information
A. Concrete Mix Design Designation (Note 2):
B. Minimum Concrete Strength f'c: _______ psi at _____ days, and
C. Maximum w/c Ratio: _________________
D. Concrete Type (check one) _____NW _____LW
E. Required Wet Weight: _________pcf
F. Concrete Use (member type as specified in General Notes):
   ______________________________________________
G. Required Air Content: __________%
H. Method of Concrete Placement for this Mix:
   (check one) ____ Bucket  ____ Pump  ____ Chute  ____ Tremie  ____ Other (Specify) __________________

III. Method of Concrete Mix Design Preparation:  (Check One Method Below) (Note 3)
A. _____ Field Experience Method  B.  _____ Trial Mixture Method

IV. Concrete Production Facility Information
A. Production facility has field strength test records of specified class or within 1 ksi of class:  ____ Yes  ____ No
Answer B thru C only if answer to IV.A. is "yes". If answer to IV.A. is "no", go to V.B.:
B. Test Record Information:  (Check either 1, 2, or 3 below)
1. _____ ≥ 30 consecutive tests          2.  _____ Two groups of ≥ 30 tests          3.  _____ 15 to 29 tests
C. Standard Deviation S(PSI):
   1. Modification Factor (if B.3. checked only.  Ref. Table 5.3.1.2 of ACI 318-02.) MF = __________
   2. Standard Deviation S = _______ psi          3.  MF x S (if B.3. checked only) = _______ psi

Note: Combined aggregate gradation for slabs and other designated concrete shall be 8% -18% for large top size aggregates (1 ½ in.) or 8%-22% for smaller top size aggregates (1 in. of ¾ in.) retained on each sieve below the top size and above the No. 100 sieve.

V. Required Average Compressive Strength f'cr (psi)
A. Calculation of f'cr from S (fill out only if IV.A. is "yes) (larger of 1 or 2 below controls)
   1. f'cr = f'c + 1.34 x S = _______ psi          2.  f'cr = f'c + 2.33 x S - 500 = _______ psi
B. Calculation of f'cr from ACI 318-02 Table 5.3.2.2:  (fill out if IV.A. is "No")
   1. f'cr = f'c + _______ psi = _______ psi

VI. Concrete Mix Design by Field Experience Method:  (fill out below only if III.A. is checked)
Note: This method requires one or more mix designs with a 45 day minimum field record of at least ten consecutive test results using similar materials and conditions as the proposed mix design.
A. Available field record is based on how many mix designs?  ______________ (specify number)
B. Average strength of field record is _______ psi (must be ≥ f'cr in V.)

VII. Concrete Mix Design by Trial Mixture Method:  (fill out below only if III.B. is checked)
Note: This method requires using at least three different trial mixes with varying W/C ratios or cement contents
with a plot of average strength vs. W/C ratio or cement content.  Submit scale graph of results.
A. Trial Mixes:  (Note:  All other ingredients as specified in VIII. below)

<table>
<thead>
<tr>
<th>Mix</th>
<th>Cements (lbs.)</th>
<th>W/C Ratio</th>
<th>Compressive Strength (psi) at Specified Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Selected (interpolated) values</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VIII. Proposed Mix Design
A. Sources of Materials:
2. Fly Ash: Type: _____ Manufacturer: _____________ Sp. Gr. __________
3. Silica Fume: Manufacturer: ______________ Type (check one): ___ Slurry ___ Powder
   Slurry: Specific Gravity _______ Water Content by Wt. _____% Silica by Wt. _____% Silica by Wt. _____%
   Powder: Specific Gravity _______ Silica by Wt. _____%
   (Note 4) Oven-dry Rodded Density: _______ PCF Absorption: _____ % (moist. content at SSD cond.)
   (Note 4) Ovendry Rodded Density: _____ PCF Absorption: ____% (moist. content at SSD cond.)
6. Fine Aggregate: Type: _____ Source: _______________ Fineness Modulus: ______________________
   (Note 4) Ovendry Sp. Gr. ______ Absorption (moisture content at SSD condition): ____%
Note: Specify below all types and combinations of admixtures anticipated to be used for all anticipated weather conditions. Explain in (12) below.
8. Water Reducers (WR):
   a. (Plain) Manufacturer and Name: ____________________________________ ASTM No. _________
   b. (w/Accelerator) Manufacturer and Name: ____________________________ ASTM No. _________
   c. (w/Retarder) Manufacturer and Name: ______________________________ ASTM No. _________
9. Accelerators: Manufacturer and Name: _______________________________ ASTM No. _________
10. Retarders: Manufacturer and Name: ____________________________________ ASTM No. _________
11. High Range Water Reducer (HRWR) (Superplasticizers):
   a. (Plain) Manufacturer and Name: ____________________________________ ASTM No. _________
   b. (w/Retarder) Manufacturer and Name: _______________________________ ASTM No. _________
12. Comments: ___________________________________________________________________________
B. Mix Proportions: (Per Cubic Yard)
   Item Wt. (lbs.) Absolute Vol. (Cu. Ft.)
   1. Cement
   2. Fly Ash
   3. Silica Fume
   4. Coarse Agg. (SSD Wt.)
   5. Lightweight Agg. (SSD Wt.)
   6. Fine Agg. (SSD Wt.)
   7. AEA oz/100# cement Added at: ___ Batch Plant ___ Site
   8. a. WR (Plain) oz/100# cement Added at: ___ Batch Plant ___ Site
   b. WR (W/Acc.) oz/100# cement Added at: ___ Batch Plant ___ Site
   c. WR (W/Ret.) oz/100# cement Added at: ___ Batch Plant ___ Site
   9. Accelerator: oz/100# cement Added at: ___ Batch Plant ___ Site
   10. Retarder: oz/100# cement Added at: ___ Batch Plant ___ Site
   11. a. HRWR (Plain) oz/100# cement Added at: ___ Batch Plant ___ Site
   b. HRWR (w/Ret.) oz/100# cement Added at: ___ Batch Plant ___ Site
   12. Other:  ________________________________________________________ (Specify Units)
   13. Water (including free water on aggregates) ________ (lbs.) ________ (cu. ft.) ________ (gal.)
   14. Water (including free water on aggregates)/(Cement + pozzolan): 

C. Mix Design Characteristics: (Pozzolan = flyash and/or silica fume)
   1. Water (including free water on aggregates)/Cement + pozzolan): 
   2. Fine Aggregate/Total Aggregate = 3. Pozzolan/Pozzolan+Cement) =
   4. Concrete Density: a. Unit Wet Weight (lbs.) _____ pcf  b. Unit Dry Weight (lbs.) _____ pcf
   5. Air Content: _____%
   6. Slump or Slump Flow a. Initial Slump (before adding WR or HRWR) _____ in. b. Final Slump or Flow (after adding WR or HRWR or SCC) _____ in.
D. Chloride Ion Content: The Concrete Supplier certifies that total chloride ion content of the concrete mix, as tested by ASTM C 1218 does not exceed the amounts specified in Table 4.4.1 of ACI 318.
E. Alkali Content: The Concrete Supplier certifies, if required by specification section 3300, that the total alkali content contributed from cementitious materials does not exceed 4.0 lbs./cu. yd. of concrete or certifies that the aggregate contains no deleterious material that react with alkalis in the concrete mix.
F. Mix Water Purity: The Concrete Supplier certifies that the appropriate specified chemical concentration limits are not exceeded in the total volume of mix water.

Notes:
1. This form is required to be submitted to Engineer and District's Testing Laboratory for all concrete mixes on the job. When any mix ingredient changes during the course of the job, this submittal form shall be resubmitted for approval. All information must be filled in for approval of mix design. Submit all backup data for calculations.
2. The mix designation should be that used by the Contractor to order the concrete from the Supplier and as noted on the batch ticket.
3. Refer to ACI 318 for requirements of each concrete mix design preparation method.
4. Submit sieve analysis of fine and course aggregates. Include chart indicating combined aggregate retained on each sieve size.
X. Certification by Concrete Supplier

Signature: ______________________________ Representing: __________________________ Date: _____________
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete finishes.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
1. Section 03 30 00 - Cast-In-Place Concrete: Provision of cast-in-place concrete.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

1.3 SYSTEM DESCRIPTION

A. Performance Requirements
1. Provide smooth concrete surfaces at exposed cast-in-place concrete, utilizing steel, fiberglass or plastic coated forms or any other kind of material that will impart no pattern to concrete.
2. Pour joints of cast-in-place concrete shall align with reveals, rustication joints and/or control joints as indicated on the Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete: As specified in Section 03 30 00.

B. Curing Compound: ASTM C309, and shall conform with all applicable air pollution regulations.

C. Crack Repair Materials
1. Sealer: As manufactured by Radon Mitigation & Concrete Waterproofing Co., “RadonSeal Concrete Sealer”, or equal.
2. Filler: 2-component injectable compound, quick curing, high strength bonding for permanent repair, as manufactured by Radon Mitigation & Concrete Waterproofing Co., “RadonSeal CrackWeld”, or equal.

D. Self-Leveling Underlayment and Topping: Cement-based, polymer-modified, self-leveling product that shall be applied in thicknesses from 1/8-inch and that shall be feathered at edges to match adjacent floor elevations as required.
   1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
   2. Primer: Underlayment manufacturer’s standard product recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8-inch to 1/4-inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4,100 psi at floor and slab areas beneath floor coverings and not less than 5,000 psi at floor and slab areas remaining exposed; tested at 28 days according to ASTM C109.
   5. Products

E. Sealer
   1. At New Concrete: Clear liquid applied, dual barrier penetrating slab and water repellent sealer to form crystalline barrier beneath surface that is not affected by ultraviolet light or abrasion, which also creates a water repelling membrane of methylsilane at the surface to prevent penetration of moisture, oils, fuel, chloride ions and other contaminates into the substrate.
      a. Product: As manufactured by Creteseal, “CS2000”, or equal (no known equal).
   2. At Existing Exposed Concrete: Highly durable, 1-component, clear, acrylic-polyurethane sealer to improve resistance to staining, abrasion, and the effects of UV radiation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting application of subsequent finishes.

B. Do not proceed with application until unsatisfactory conditions have been corrected.
3.2 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by stock form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated. Slope surfaces exposed to weather to drain.

3.3 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, pavers and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerance not exceeding 1/2-inch in 10 feet when tested with a 10 feet straightedge, or to tolerance of F(F) not less than 15 (floor flatness) and F(L) not less than 13 (floor levelness) measured according to ASTM E1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, or as otherwise indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 5/16-inch in 10 feet when tested with a 10 feet straightedge or to tolerance of F(F) not less than 20 (floor flatness) and F(L) not less than 15 (floor levelness) measured according to ASTM E1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Provide square corners in slab depressions.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with access flooring, resilient flooring, carpet, thin set ceramic or paver, or thin film finish coating system.

1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 3/16-inch in 10 feet when tested with a 10 feet straightedge or to tolerances of not less than F(F) 30 (floor flatness) and F(L) not less than 20 (floor levelness) measured according to ASTM E1155. Grind smooth any surface defects that would telegraph through applied floor covering system.
D. Non-slip Broom Finish: Apply a non-slip broom finish to exterior concrete platforms, steps, and ramps, loading dock and other accessible routes of travel as indicated. Provide slip resistance of minimum 0.6 coefficient of friction in accordance with ASTM D2047.
   1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with the Architect before application.
   2. Finish equal to medium broom finish at slopes less than 6 percent.
   3. Finish equal to heavy broom finish at slopes greater than or equal to 6 percent.

E. Refer to Section 03 30 00 for additional concrete finishing and curing requirements.

3.4 POLISHED CONCRETE

A. Preparation
   1. Ensure substrate is clean of materials and debris.
   2. Protection adjacent surfaces as required to prevent damage by the concrete polishing procedure.
   3. Ensure substrate is sufficiently cured to accept polishing application.

B. Grinding and Polishing
   1. General
      a. Grind the floor to within 1-2 inches of walls, removing floor slab imperfections until there is a uniform scratch pattern and desired concrete aggregate exposure is achieved.
      b. Vacuum the floor thoroughly after each grind, using a squeegee vacuum attachment.
   2. First Pass: Use metal bonded diamond grit of 100.
   3. Second Pass
      a. Use metal bonded diamond grit of 200.
      b. Grind 90 degrees from previous grind and remove all scratches from the previous grit.
   4. Polish the floor using phenolic resin bonded diamond grits as required to meet sheen level 2 as defined by IPCI; at a distance of 30 to 50 feet, the floor will clearly reflect from side and overhead lighting.
   5. Clean the floor thoroughly using clean water and an autoscrubber or a mop and a wet vacuum.

C. Apply sealer in accordance with Article 3.05.

3.5 SEALER

A. Apply appropriate sealer for new or existing exposed concrete exactly in accordance with manufacturer’s written instructions, using manufacturer’s recommended equipment and method.

B. Apply the number of coats recommended by manufacturer.
3.6 CONCRETE SURFACE REPAIRS

A. Intent of this Specification is to require forms, mixtures of concrete and workmanship so that concrete surfaces will require no patching, except for plugging of tie holes.

B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to the Architect.

C. Mix dry-pack mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
   1. Cut out honeycombs, rock pockets, voids over 1/4-inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
   2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

D. Repairing New Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
   1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete’s durability. If defects cannot be repaired, remove and replace the concrete.

E. Repairing New Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
   1. Repair finished unformed surfaces containing defects that affect the concrete’s durability. Surface defects include crazing and cracks in excess of 0.01-inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
   2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
   3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to the Architect.
   4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same
type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

5. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. At Existing Floors and Slabs

1. Crack Repairs
   a. Seal the crack with deep-penetrating concrete sealer to preserve and strengthen concrete against further cracking; sealer may be sufficient to repair fine hairline cracks and cracks that are narrow inside.
   b. Before filling the crack, ensure the inside of the crack is clean and dry; duct tape may be placed on both sides of the crack to make clean-up easier, particularly on rough surfaces.
   c. Basic Repair Steps
      1) Inject the resin into the crack to wet the surfaces and make them tacky.
      2) Push dry silica sand into the crack to fill it.
      3) Thoroughly saturate the sand with resin to fill it to the surface.
      4) In 10 to 15 minutes, scrape off the surface to make it level and use sandpaper for neat appearance.
   d. Hairline cracks which are too narrow for sand are filled and repaired with 2 passes of the resin.
   e. If additional sand is needed, use a completely dry graded sand (no fines) or ideally, sandblasting sand with granulation like table sugar (30 to 40 grit) or similar sand without fines.
   f. To repair wide cracks or cracks with a void underneath, first fill the crack partially with sand to prevent the resin from running out.
   g. To prevent plugging, maintain a steady flow of resin through the mixing nozzle. After a stoppage, purge the mixer into a disposable cup. To minimize stoppages, repair small sections of the crack at a time say, 5-10 feet, or use up the whole cartridge. Fill the crack with sand in 2 to 3 minutes after priming while resin is still tacky. On larger jobs, use a helper to do the scraping.

2. Floor Leveling: Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

G. Perform structural repairs in accordance with Section 03 30 00.

H. Repair methods not specified above may be used, subject to acceptance of the Architect.

3.7 PROTECTION

A. Restore finishes damaged during installation and construction so that no evidence remains of correction work.

END OF SECTION
SECTION 03 45 00

PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Precast architectural concrete wall cap at trash enclosure.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
   1. Section 07 19 00 - Water Repellents: Provision of water repellents.

1.2 REFERENCES

A. ACI - American Concrete Institute
   1. 211.1 - Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   2. 318 - Building Code Requirements for Structural Concrete.

B. ASTM - American Society for Testing and Materials
   5. A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

C. CBC - California Building Code, 2016 Edition

D. CRSI - Concrete Reinforcing Steel Institute
E. PCI - Precast/Prestressed Concrete Institute
   1. MNL 117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.
   2. MNL 120 - Design Handbook-Precast and Prestressed Concrete.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixes: For each concrete mix.

C. Samples: For each type of finish indicated on exposed surfaces of precast architectural concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.

D. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast architectural concrete units similar to those indicated for this Project and with a record of successful in-service performance.
   1. Assumes responsibility for engineering precast architectural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified California licensed professional engineer with at least 5 years experience.
   2. Participates in PCI’s Plant Certification program and is designated a PCI-certified plant for Group A, Category A1-Architectural Cladding and Load Bearing Units.
   3. Has sufficient production capacity to produce required units without delaying the Work.
   4. Is registered with and approved by authorities having jurisdiction.

B. Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120.

C. Quality Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast architectural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

B. Lift and support new units only at designated lifting and supporting points as shown on shop drawings.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Dura Art Stone; Stepstone, Inc., or equal.

2.2 MOLD MATERIALS

A. Molds: Provide molds of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes.

2.3 REINFORCING MATERIALS

A. Galvanized Reinforcing Bars: ASTM A767, Class II zinc coated, hot-dip galvanized after fabrication and bending, as follows:
   1. Steel Reinforcement: ASTM A615, Grade 60 deformed.

B. Steel Bar Mats: ASTM A184, assembled with clips, as follows:
   1. Steel Reinforcement: ASTM A615, Grade 60, deformed bars.

C. Deformed-Steel Wire: ASTM A496.


E. Supports: Manufacturer’s bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI’s MSP, PCI MNL 117, and as follows:
   1. For uncoated reinforcement, use all-plastic bar supports.
   2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I, of same type, brand, and source. Color to match existing.

B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33, with coarse aggregates complying with Class 5S.

C. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining.

D. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Architect.

F. Coloring Admixture: ASTM C979, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.

G. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

H. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

I. Water-Reducing Admixture: ASTM C494, Type A.

J. Fly Ash Admixture: ASTM C618, Class C or F.

2.5 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

2.6 CONCRETE MIXES

A. Prepare design mixes for each type of concrete required.
   1. Limit use of fly ash to not exceed, in aggregate, 25 percent of portland cement by weight.

B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast architectural concrete fabricator’s option.
   1. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318.

C. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 5,000 psi.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.

D. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.

E. Add air-entraining admixture at manufacturer’s prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

F. When included in design mixes, add other admixtures to concrete mixes according to manufacturer’s written instructions.
2.7 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing operations.

B. Maintain molds to provide completed precast architectural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

C. Edge and Corner Treatment: Square edge, or as indicated on the Drawings or approved shop drawings.

2.8 FABRICATION

A. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B. Reinforcement: Comply with recommendations in CRSI’s MSP and PCI MNL 117 for fabricating, placing, and supporting reinforcement. Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses.

C. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.

D. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete.

E. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

F. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Architect.

2.9 FINISHES

A. Finish exposed-face surfaces of precast architectural concrete units to match approved sample units.

B. Finish exposed top, bottom and back surfaces of precast architectural concrete units to match face-surface finish.

C. Finish unexposed surfaces of precast architectural concrete units by float finish.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Visit the project site and record existing conditions. Confirm all existing dimensions.

B. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Do not install precast concrete units until supporting steel is in place and concrete has attained minimum design compressive strength.

3.2 INSTALLATION

A. Install precast architectural concrete. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.

B. Anchor precast architectural concrete units in position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and grouting are completed.

C. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 REPAIRS

A. Remove and replace damaged precast architectural concrete units if repairs do not comply with requirements.

3.4 CLEANING

A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.

B. Wash and rinse according to precast concrete fabricator’s written recommendations. Protect other work from staining or damage due to cleaning operations.

C. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

END OF SECTION
SECTION 04 22 00

REINFORCED CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Related Sections

1. Section 03 20 00 – Concrete Reinforcement

2. Section 03 30 00 – Cast-in-Place Concrete

3. Section 0512 00 – Structural Steel

1.2 DESCRIPTION OF WORK

A. Extent of each type of reinforced concrete unit masonry (CMU) work is indicated on the architectural and structural drawings and in schedules. Provide all labor, materials, equipment, and services necessary for and incidental to the installation of all reinforced masonry construction as indicated on the drawings and specified herein.

B. Work includes but is not limited to, masonry units, mortar, grout, reinforcing steel, control joints, integral water repellant admixtures, and testing and inspection.

C. Accessories include, but are not necessarily limited to ties, horizontal and vertical reinforcement, anchors to the structure, and control joints.

D. The masonry contractor shall install all accessory items that are required in the work and supplied by others, including: bolts, nailing blocks, inserts, anchors, flashing, steel lintels, expansion joints, conduits, cast-stone trim, hollow-metal door frames, etc.

1.3 CODES AND STANDARDS

A. Comply with the provision of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1. California Code of Regulations, Title 24, 2016 edition, also known as California Building Code (CBC), with Division of the State Architect (DSA) amendments.

2. ACI 530.1/ASCE 5/TMS 402, Specifications for Concrete Masonry Structures.

4. ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”

5. ASTM Standards
   a. ASTM C5 - Specification for Quicklime for Structural Purposes
   b. ASTM C90 - Specification for Load Bearing Masonry Units
   c. ASTM C140 - Test Method Sampling and Testing Concrete Masonry and Related Units
   d. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar
   e. ASTM C270 - Specification for Mortar for Unit Masonry
   f. ASTM C404 - Standard Specification for Aggregate for Masonry Grout
   g. ASTM C476 - Specification for Grout for Masonry
   h. ASTM C 618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete

1.4 QUALITY ASSURANCE

A. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

B. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious

C. All masonry work shall comply with the standards and requirements of the above references. Where discrepancies exist between the references and the Contract Documents, the requirements of the Contract Documents shall govern.

D. Masonry Preconstruction Testing Service: Employ and pay for the services of an independent testing laboratory acceptable to Architect and experienced in performing types of preconstruction masonry tests indicated. The testing laboratory shall meet the basic requirements of ASTM E 329 and have current accreditation from either the American Association for Laboratory Accreditation, the AASHTO Accreditation Program, or the “NIST” National Voluntary Laboratory Accreditation Program.

1. Preconstruction Verification by Unit Strength Method
   a. Concrete Masonry Units: For each type of concrete masonry wall construction shown on the structural or architectural drawings, submit results of tests conducted in accordance with ASTM C140 that demonstrate that the strength of the concrete masonry units are consistent with required compressive strength of the masonry construction shown on the drawings.
   b. Mortar: Submit the proportions of the mortar mix to verify compliance with the specified type.

2. Masonry work will not begin until test results are submitted to and approved by the Architect/Engineer.
1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements. Provide certification of pull-out strength of all masonry ties and anchors. Submit certification of compliance with required standards for all masonry units.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars and for templates for layout of dowels for columns and pilasters. Comply with the fabrication tolerances of ACI 315, “Details and Detailing of Concrete Reinforcement.” Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work. Shop drawings shall also indicate the locations of all conduits, plumbing and other items embedded in masonry walls.

C. Mix Designs:

1. Mortar mix proportions for type of mortar required to achieve specified compressive strength of masonry.

2. Grout mix proportions shall be according to ASTM C476 for the types of grout required for the work. Submit manufacturer’s literature for grout admixtures. Alternatively, proportions by mortar type shall be used as given in CBC Table 2103A.11.

3. For grout mixes, submit a history of compression tests which substantiates the compressive strength of the proposed mix, in accordance with ACI 318 section 5.3.

D. Certificates: Prior to delivery, submit to the District’s Testing Laboratory and Architect/Engineer certificates attesting compliance with the applicable specifications for grades, types or classes of all products included in these specifications.

1. Masonry Unit certificates stating that all units have been properly cured before shipment and that they conform to all the requirements of these specifications.

2. All materials required for mortar and grout including type, source, brand, and name of manufacturer.

3. Each combination of masonry unit type and mortar type. Include statement of net area compressive strength of masonry units, mortar type and net compressive strength of masonry determined according to Table 2 in ACI 530.1/ASCE 6/TMS 602

4. Mill Certificates: Steel producer’s certificates of mill analysis, tensile and bend test for reinforcing steel required for project per specification section 03 20 00.
E. Unit Samples – submit sample concrete masonry units in each color and texture combination specified.

F. Accessories – submit samples of all accessories embedded in masonry.

G. Extreme Weather Procedures – submit Hot Weather construction procedures evidencing compliance with the requirements specified in ACI 530, CBC, and these specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes. During freezing weather, protect masonry units with tarpaulins or other suitable material. If units become wet, do not install until they are dry.

C. At the time of delivery, the linear shrinkage of masonry units shall conform to the requirements of ASTM C90.

D. Store cementitious materials and masonry units off the ground, under cover and in dry location. All materials must be protected from wetting by capillary action, rain, or snow, and protected from mud, dust, or other materials and contaminants likely to cause staining or defects.

E. Reject and remove from the site all material not conforming to specification requirements. In addition to lack of conformance to manufacturers’ specifications, masonry units shall be rejected if:

1. The color or texture of the concrete masonry units deviates from the range of colors and textures displayed on approved mock-up, as determined by the Architect.

2. Concrete masonry units are chipped, cracked, or otherwise damaged.

F. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying in dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

G. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

H. Store masonry accessories, including metal items, in such a way as to prevent corrosion or accumulation of dirt and oil.
1.7 PROJECT CONDITIONS

A. Protection of Work: The Contractor shall construct and maintain temporary protection as required to permit continuous progress of the work. During erection, cover top of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.


PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Manufacturers:

1. RCP Block; www.rcpblock.com

2. Basalite; www.basalite.com

3. Calstone; www.calstone.com

4. Substitutions: Section 01 63 00 – Product Options and Substitutions.

B. Basis of Design Product: - match existing split-face texture and color.

C. Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required.

D. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions. All special shapes provided shall match approved samples available for inspection by the Architect.

E. Provide square-edged units for outside corners, except where indicated as bullnose.

F. Provide units complying with the characteristics indicated below for type, size, strength, and weight.

1. Hollow Load bearing Block: ASTM C 90 Lightweight (105 pcf) open end type concrete blocks.
2. Unit Compressive Strength: Provide units with a minimum average net-area compressive strength of 1900 psi.

3. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x nominal thicknesses as shown on the drawings.

4. Color and Finish
   a. Class A – Precision Face; Color = Standard Grey; typical unless noted otherwise on the drawings.
   b. Class B – Split Face; Colors shall be as noted on the Architectural drawings.

5. Fly Ash: ASTM C618, Class F, except that Loss on Ignition (LOI) shall not exceed 1.0 percent.
   a. Fly Ash: 100-percent, reclaimed, post consumer waste.

6. Integral Water Repellent Admixture
   a. Description: An integral liquid polymeric admixture mixed with concrete during production of CMU which cross links and becomes permanently locked into the CMU, bond beam, or CMU lintel to provide resistance to water penetration to achieve a Class E Rating when tested in accordance with ASM E514.

2.2 MASONRY LINTELS
   A. Built-in-place masonry lintels made from bond beam Concrete Masonry Units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.3 MORTAR AND GROUT MATERIALS
   A. Do not use calcium chloride in mortar or grout.
   B. Mortar: ASTM C 270, Proportion Specification, Type S:
      1. Portland Cement: ASTM C150, Type II
      2. Hydrated Lime: ASTM C207, Type S
      3. Quick Lime: ASTM C5
      4. Aggregates: ASTM C144
      5. Water: Clean and potable, free from impurities detrimental to grout.
6. Mortar Coloring: Mineral oxide type

7. Admixture: An integral liquid polymeric admixture designed specifically for use in a mortar mix, which cross links and becomes permanently locked into the mortar to provide resistance to water penetration, achieving a Class E Rating when tested in accordance with ASM E514; same as “Dry Block”® integral water repellent admixture by Grace Construction Products, or equal product substituted per Section 01 63 00 Product Options and Substitutions.

C. Grout: Provide grout that conforms to either of the two requirements below per TMS602/ACI530/ASCE6:

1. ASTM C 476, Proportion Specification
   a. Portland Cement: ASTM C150, Type II
   b. Fly Ash: ASTM C618, Class F, except that Loss on Ignition (LOI) shall not exceed 1.0 percent.
      (1) Fly Ash: 100-percent, reclaimed, post consumer waste.
   c. Aggregates: ASTM C404
   d. Water: Clean and potable, free from impurities detrimental to grout.

2. The material requirements of ASTM C 476; attains the specified compressive strength or 2000 psi, whichever is greater, at 28 days when tested in accordance with ASTM C 1019; has a slump flow of 24 in. to 30 in. as determined by ASTM C 1611; and has a Visual Stability Index (VSI) less than or equal to 1 as determined in accordance with ASTM C1611.

3. Grout consistency is to be coarse grout unless fine grout is required by ACI530.1/ASCE6/TMS602 based on minimum grout space dimensions coupled with maximum pour heights or unless a stricter requirement is defined by the local code.

4. Grout Admixture: Required in all grout to reduce early water loss to the masonry units, to produce expansive action in the plastic grout to offset the initial shrinkage and to promote bonding of grout to the masonry unit surfaces. Use Grout Aid by Sika Corporation or approved equal. Obtain approval of admixture by Architect, Structural Engineer and the District’s Testing Agency.

2.4 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60, in compliance with the requirements of Section 03 20 00.

2.5 TIES AND ANCHORING DEVICES

A. General:

1. Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics.
2. Manufacturers:
   a. Subject to compliance with requirements, provide products of one of the following:
      (1) AA Wire Products Co.
      (2) Dur-O-Wall, Inc.
      (3) Hohmann & Barnard, Inc.
      (4) National Wire Products Corp.
      (5) Heckman Building Products
   b. Other manufacturers shall be used only with Engineer approval. The Contractor shall submit technical literature for all reinforcing units.

3. Finishes: Provide ties, and anchors specified in subsequent paragraphs that are made from materials or that have the finishes that comply with the subparagraphs below, depending on the finish specified, unless otherwise indicated.
   a. Mill Galvanized Finishes
      (1) Joint Reinforcement: ASTM A 641 (0.1 oz/ft²)
      (2) Sheet-metal ties and anchors: ASTM A 653 G60
   b. Hot-Dip Galvanized Finishes
      (2) Sheet-metal Ties and Anchors: ASTM A 153, Class B
      (3) Steel Plates and Bars: ASTM A 123 or ASTM A 153, Class B

B. Bent Wire Ties: Provide individual prefabricated bent-wire units complying with requirements indicated below:

1. Materials and Finishes:
   a. Galvanized: ASTM A 82

2. Wire Size: 0.1875" diameter.

3. Length: Provide units of length indicated but not less than that required for embedment of at least 1 ½ " into the mortar bed of solid units or solid grouted hollow units and for a minimum of 1/2" embedment of tie end into outer face shells of hollow units, with not less than 5/8" mortar cover on exterior face joints, 1/2" elsewhere.

4. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with ends welded closed and not less than 4" wide.

5. Tie Shape for Solid Masonry Units or hollow units laid with cells horizontal: Z-shaped ties with ends bent 90° to provide hooks not less than 2" long.
C. Anchor Bolts: Provide headed steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM A 153, Class C, in sizes and configurations indicated.

D. Post-Installed Anchors:

1. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published Evaluation Report specifically addressing anchorage to hollow or fully grouted concrete masonry shall be approved for use.

2. Type:
   a. Fully Grouted Concrete Masonry: Anchors into fully grouted masonry shall be either chemical anchors or expansion anchors specifically approved by ICC-ES for use in fully-grouted concrete masonry.

3. Finish:
   a. Exterior or Exposed Use: All anchors, nuts, and washers for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors, nuts and washers shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel and nuts and washers from 300 series or Type 18-8 stainless steel.

2.6 FABRICATION

A. Concrete Masonry Units: Blocks shall have been air cured for not less than 28 days.

B. Reinforcement:

1. Shop-fabricate to comply with Drawings.

2. Conform with requirements of ACI 315 where specific details are not shown or where Drawings and Specifications are not more restrictive.

2.7 MIXES AND MIXING

A. Mortar

1. Conform to ASTM C270, Type M or S. Compressive Strength shall be 2,000 psi minimum after 28 days.

2. Mix Mortar in accordance with TMS602/ACI530/ASCE6 Article 2.6.A.

3. Use and place mortar in final position within 2½ hours after mixing.
   a. Mortar which has stiffened as a result of evaporation of water may be re-tempered with water as frequently as required to restore required consistency during this time period.

B. Grout
1. Compressive Strength: Minimum 2,000 psi after 28 days.

2. Slump: 9- to 10-inches, depending on temperature and humidity conditions.

3. Grout mix shall comply with the requirements of TMS602/ACI530/ASCE6 Article 2.6.B as modified by CBC 2103A.12.

4. Fly Ash may be used to replace 20 percent of Portland Cement.

5. Mix in grout admixture in accordance with the manufacturer’s requirements.

6. Use sufficient water to make a workable mix that will flow into all joints of the masonry units with typical rates of absorption for ASTM C90. Do not add water at the job site.

7. Site mixing of grout shall not be permitted without review and acceptance by the Structural Engineer and DSA.

C. Quality Control – The District’s Testing Laboratory shall:

1. Collect mill test reports for reinforcement in compliance with Section 03 20 00.

2. Take samples of reinforcement and test per Section 03 20 00.

3. Collect plant certificates from the Contractor for concrete masonry units, stating that all units have been properly cured before shipment and that they conform to all the requirements of these specifications. All masonry units shipped without certification will be rejected.

4. Sample and test concrete masonry units for compressive strength, unit weight, absorption and moisture content in accordance with ASTM C140.

5. Test for moisture content and drying shrinkage in accordance with ASTM C426.

6. Take and test Portland cement grab sample per Section 03 30 00.

7. Verify f’m prior to construction per TMS602/ACI530.1/ASCE-6 Article 1.4B.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Inspect surfaces that are to support masonry work to assure completion to proper lines and grades and are free of dirt and other deleterious material. Do not begin work until surfaces not properly prepared have been satisfactorily corrected.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance
2. Verify that foundations or other supporting surfaces are within specified tolerances.

3. Verify that reinforcing dowels are properly located and free from loose scale, dirt, concrete and other bond inhibiting substances.

4. Examine rough-in and built-in construction to verify actual locations of piping connections.

B. Clean concrete surfaces to receive masonry and roughen concrete surfaces to expose aggregate to ¼” amplitude. Comply with CBC 1906A.4.

C. Hot Weather Requirements

1. Implement the requirements of approved Hot Weather construction procedures when ambient air temperature exceeds 100 degrees F or 90 degrees F with a wind velocity greater than 8 mph. Comply with CBC section 2104A.4 and ACI 530.1 article 1.8D for hot weather requirements

2. Dampen concrete surfaces before laying masonry blocks.

D. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

E. Installation of Masonry, General:

1. Build cavity and composite walls, floors and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

2. Build chases and recesses as shown or required for the work of other trades. Provide not less than 8" of masonry between chase of recess and jamb of openings, and between adjacent chases and recesses.

3. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

4. Cut masonry units using motor-driven dry-cutting or water-cooled saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous patterns and to fit adjoining work. Use full-size units without cutting where possible.

5. Install cut units with cut surfaces and, where possible, cut edges concealed.

F. Do not install cracked, broken, or chipped masonry units exceeding ASTM allowances.

G. Protect sills, ledges, and offsets from mortar droppings or other damage during construction. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface. Remove misplaced mortar or grout
immediately. Protect face materials against staining. Protect door jambs and corners from damage during construction.

H. Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Immediately remove grout or mortar in contact with such masonry.

I. Ensure random color variations in the installation of the masonry blocks. Transfer blocks from three delivered pallets onto a “working” pallet to be used for construction. Alternate among pallets when unloading to ensure a mix of blocks on the working pallet.

3.2 CONSTRUCTION TOLERANCES

A. Comply with tolerance in ACI 530.1/ASCE 6/TMS 602 and the following.

B. For conspicuous vertical lines such as external corners, reveals, expansion and control joints, do not exceed 1/4" in any story or 20 feet maximum, nor 1/2" maximum.

C. For vertical alignment of exposed head joints do not vary from plumb by more than 1/4" in 10 feet, nor 1/2" maximum.

D. Variation from Level: For conspicuous horizontal lines such as exposed lintels, sills, parapets, and reveals, do not exceed 1/4" in any bay or 10 feet maximum, nor 1/2" maximum. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10 feet or 1/16" within width of a single unit.

3.3 LAYING MASONRY WALLS

A. Comply with the requirements of CBC Section 2104A.5 and 2104A.5.1.2.

B. Use double open ended beam units, typical. Use proper units to provide for windows, doors, bond beams, lintels, pilaster, etc., in order to minimize cutting.

C. Align vertical cells to provide continuous, unobstructed opening for grouting.

D. Do not wet concrete masonry prior to laying up units unless written permission is obtained from the Engineer.

E. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate location of openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units, particularly at corners, jambs and wherever possible at other locations.

F. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.

G. Bond Pattern: Lay masonry in one-half running bond with vertical joint in each course centered on units in courses above and below, typical unless noted otherwise on the drawings. Do not use units with less than nominal 4” horizontal face dimensions at corners or jambs.
H. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third unit for one-third running bond. Do not tooth. Clean exposed surfaces at set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

I. Built-in Work: Install bolts, anchors, nailing blocks, inserts, frames, vent flashings, conduit, and other built-in items specified under this and other sections of these specifications as masonry work progresses. Avoid cutting and patching. Solidly grout spaces around built-in items. Provide joints around exterior framed openings 1/4” to 3/8” wide, raked and tooled smooth to a uniform depth of 3/4”, ready for caulking by others. Build chases, do not cut. Consult other trades in advance and make provisions for installation of their work to avoid cutting and patching. Install chases minimum of one full masonry unit length from jambs.

1. Fill in space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core, unless detailed otherwise.

3. Fill cores in hollow concrete masonry units with grout to supporting beam or slab below under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

J. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

1. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units, in addition to masonry bonding.

K. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:

1. Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

L. Intersecting Load-bearing Walls: If carried up separately, block or tooth vertical joint with 8" maximum offsets and provide rigid steel anchors spaced not more than 4'-0" o.c. vertically, or omit blocking and provide rigid steel anchors at not more than 2'-0" o.c. vertically. If used with hollow masonry units, embed ends in mortar-filled cores.

3.4 MORTAR BEDDING AND JOINTING

A. Provide uniform nominal joint thickness of 3/8” for concrete masonry units, unless noted otherwise on the drawings.
B. Lay masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not furrow bed joints or slush head joints.

C. Joint Profile: Provide weather-proof, concave, tooled joints in exposed surfaces when mortar is thumbprint hard, using round jointing tool. Strike joints flush in surfaces to be plastered, stuccoed, or covered with other material or surface-applied finish other than paint. Concave tool exterior joints below grade. Remove mortar protruding into cells or cavities to be grouted. Do not permit mortar droppings to block weep holes. Do not fill horizontal joints between top of masonry partitions and underside of concrete or steel construction with mortar unless specifically shown on the drawings. If not shown otherwise, provide 1" clear joint to be filled with caulk. Keep movement joints clean of all mortar and debris. For tuckpointing, rake mortar joints to a depth of 1/2 to 3/4 in., saturate with clean water, fill solidly with pointing mortar, and tool to match existing joints.

D. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners of jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

3.5 CONSTRUCTION STABILITY

A. Design, provide and install bracing that will assure stability of masonry during construction.

B. Allow 48 hours to elapse after completion of masonry columns and walls before placing floor or roof construction loads. Allow an additional 48 hours before applying concentrated loads such as girders, beams, or trusses.

3.6 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at the spacing indicated. Prior to grouting, support and secure vertical bars against displacement. Horizontal and vertical bars shall be held in position by wire positioners or spacing devices at bar ends and at intervals not exceeding 8'-0", and as otherwise required to prevent displacement by construction loads and grouting operations. Provide a minimum clearance of 1/4" if fine grout is used or 1/2" if coarse grout is used from the face of the masonry and not less than one bar diameter or 1" (whichever is greater) between adjacent bars.

C. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1-1/2 times the nominal bar diameter or 1-1/2", whichever is greater. Provide lateral ties as indicated.

D. All dowels shall be grouted into a cell even if the dowel is in an adjacent cell to the vertical steel. Unless detailed otherwise on the drawings, dowels shall be the same size and
number as the vertical steel. Unless noted otherwise provide a lap length of dowels to vertical reinforcement equal to 50 times the nominal dowel diameter.

E. All horizontal reinforcing steel shall be placed in continuous bond beam or lintel block units and shall be solidly grouted in place. Maintain a minimum of one bar diameter or 1" (whichever is greater) clearance between adjacent bars and a minimum of 1/4" clearance if fine grout is used or 1/2" if coarse grout is used from the face of the masonry. Horizontal reinforcement may be placed as the masonry work progresses.

F. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Engineer. Where splices occur, adjacent splices shall be staggered so that no more than 25% of the total number of bars are spliced at any one point with a minimum stagger between splices in adjacent bars of at least the lap length. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie. Minimum lap splice length shall be 50 bar diameters unless indicated otherwise.

G. Bolts and other embedded items shall be placed and securely anchored prior to grouting. Bolts shall be accurately set with templates or by other approved equivalent means.

3.7 SHORES
A. Temporary Formwork: Provide shores as required for temporary support of reinforced masonry elements.

3.8 GROUTING
A. General

1. All masonry walls shall be fully grouted.

2. All walls shall be grouted using Low-Lift grouted construction in compliance with CBC Section 2104A.5.1.2.2.
   a. Pour grout to a maximum height of 4-feet, stopping 1-1/2-inches below top of unit except at bond beam units with horizontal steel the grout shall be stopped 1/2-inch below top of unit.
   b. Delay 3 to 5 minutes allowing the excess of water to be absorbed by the masonry unit, then consolidate with mechanically vibrators.
   c. Lay-up and grout next vertical 4-feet of wall height.

3. High-Lift grouted construction may be substituted for use only when the Contractor submits a detailed proposed High-Lift Grouting procedure and the proposed High-Lift Grouting procedure is approved by DSA.

4. Grout shall be a workable mix suitable for placing without segregation, and shall be placed by pumping or approved alternate method. Grout shall be placed before initial set or hardening occurs.
5. Grout shall be consolidated by mechanical vibrators during placement and reconsolidated after excess moisture has been absorbed, but before workability is lost.

6. Grouting of any section of a wall shall be completed in one day, with no interruptions greater than one hour.

7. Provide cleanouts at every cell bottom course. Seal after inspection and before grouting with face shell plugs. Face shell plugs shall cure for 24 hours minimum and be adequately braced to resist grout pressure.

8. Mortar shall have set and cured a minimum of 36 hours prior to placement of grout. Grout walls soon after mortar has cured.

B. Specification: Comply with the requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts, grout space preparation, and grout placement, including minimum grout space, maximum pour height, maximum lift height and consolidation.

1. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

2. Place grout in lintels over openings in one continuous pour.

3. Where bond beam occurs more than one course below top of pour and vertically reinforced cells are present above the bond beam, fill bond beam course to within 1-1/2" of the top of the bond beam.

4. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

### 3.9 CONTROL AND EXPANSION JOINTS

A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown. Build-in related items as the masonry work progresses.

B. Alternate locations of control joints must be submitted by the Contractor to the Architect and Engineer for review and approval.

C. Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

D. Build in horizontal pressure relieving joints where indicated; construct joints by inserting non-metallic compressible joint filler of width required to permit installation of sealant and backer rod.

E. Provide continuous bond break at steel columns and members.
F. Provide pressure-relieving joints by adhering a continuous 3/8" thick neoprene pad below shelf angles supporting masonry veneer.

G. Leave joints around outside perimeters of exterior doors, window frames and other wall openings:

   2. Width: 1/4 in. (6.4 mm) to 3/8 in. (9.5mm).

3.10 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing:

   1. During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants. If the repairs must be made after the mortar has hardened, the joint must be raked or chiseled out to a depth of about 1/2" thoroughly wetted, and repointed with fresh mortar.

   2. To prehydrate mortars, thoroughly mix all ingredients except water in proportions used for original mortar mix; then mix again, adding only enough water to produce a damp unworkable mix which will retain its form when pressed into a ball. After 1 to 2 hours, add sufficient water to bring it to the proper consistence; that is conventional masonry mortars.

C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:

   1. Remove large mortar particles by hand with wooden paddles and non-metallic brushes, scrape hoes or chisels. Do not power wash.

   2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Do not used acid solution to remove green stain or efflorescence resulting from salts; follow recommendations of manufacturer for removal of such stains. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

   3. Clean concrete unit masonry to comply with masonry manufacturer's directions and NCMA Tek 8-2 bulletin.

D. Protection and Cleanup:
1. Provide final protection and maintain conditions in a manner acceptable to Installer, which ensure unit masonry work being without damage and deterioration at time of substantial completion.

2. Leave work area and surrounding surfaces clean and free of mortar spots, droppings, and broken masonry.

3. Upon completion of work, remove from site surplus materials, rubbish, and debris resulting from this work.

3.11 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. The District’s testing laboratory shall perform the tests and inspections required by CBC Table 1704A.5.3 Level 2 Required Verification and Inspection of Masonry Construction.

B. The District’s testing laboratory shall engage an approved, qualified masonry inspector to perform the periodic and continuous masonry inspections required per CBC Table 1704A.5.3. The masonry inspector shall be approved by DSA, shall be on site during all masonry construction. Inspection duties shall include those in CBC Table 1704A.5.3 and the following:

1. Review drawings and specifications. Meet with the Contractor to discuss requirements before work commences.

2. Meet jointly with the Contractor and the Architect to review the requirements for inspections and quality control of the masonry work.

3. Check brand and type of cement, lime (if used) and source of sand.

4. Inspect the foundation and slab bearing surfaces to ascertain that they are clean, roughened and ready to receive units.

5. Inspect reinforcing steel dowels for straightness, proper alignment, spacing, size and length.

6. Inspect anchor bolts and all other embeds for type, grade, proper alignment, spacing, size, and embedment.

7. Observe manner in which units are laid up to ensure that joints are full of mortar and kept tight during work. Inspect cells to assure that fins will not interfere with grouting. Inspect cells to ensure they are clean and free of mortar droppings.

8. Observe placing of grout continuously. Verify through continuous inspection that the placement of grout is in compliance with the requirements of the contract specifications and ACI 530.1/ASCE 6/TMS 602.
9. Mortar Joints: Throughout construction, verify that mortar joints are being prepared in accordance with these specifications and ACI 530.1/ASCE 6/TMS 602.

10. Installed items: Verify that installed flashing, weep holes, construction joints, control joints and wall vents are installed in accordance with specifications.

11. Perform or supervise performance of required sampling and field testing as specified.

12. Keep complete record of inspection of work. Make regular reports to the District’s Representative on the progress of the masonry inspection.

13. Submit verified reports to DSA.

C. The District’s Testing agency shall perform material tests and prepare reports thereof. Masonry compressive strength shall be determined by either the Unit Strength Method or the Prism Test Method.

1. Unit Strength Method
   
   a. Concrete Masonry Unit
      (1) Units shall be sampled and tested to verify compliance with ASTM C90
      (2) Collect mill certificates of the masonry units
   
   b. Mortar
      (1) At the beginning of all masonry work, take at least one test sample of mortar on three successive working days, and at least at one-week intervals thereafter. Perform compressive tests to show that mortar meets the specified compressive strength.
      (2) Additional samples shall be taken whenever any change in materials or job conditions occur, or whenever in the judgment of the architect, engineer or DSA such tests are necessary to determine the quality of the material.
      (3) Mortar test specimen shall be made in accordance with ASTM C1586.
   
   c. Grout
      (1) At the beginning of all masonry work, take at least one test sample of grout on three successive working days, and at least at one-week intervals thereafter. Perform compressive tests to show that grout meets the specified compressive strength.
      (2) Additional samples shall be taken whenever any change in materials or job conditions occur, or whenever in the judgment of the architect, engineer or DSA such tests are necessary to determine the quality of the material.
      (3) Grout test specimen shall be made in accordance with ASTM C1019.
2. **Prism Test Method**

   a. Comply with CBC 2105A.2.2.2. Construct and test all masonry prisms in accordance with ASTM C1314.

   b. Prior to the start of construction construct and test a set of five masonry prisms using materials taken from those specified for this project.

   c. During Construction construct and test one set of three prisms for each 5,000 square feet of wall area, but not less than one set of three prisms for the project.

   d. Each set of prisms shall equal or exceed the specified $f_m$.

D. The District’s Testing agency shall also:

1. Throughout construction, verify the proportions of the site-prepared mortar mix comply with the requirements of ASTM C270 for the type specified.

2. Verify the proportions of materials in premixed or preblended mortar comply with the requirements of ASTM C270 for the type specified as delivered to the site.

3. Prior to grouting, verify the proportions of site-prepared grout mix comply with the requirements of ASTM C476 for each type of grout used.

4. Report test results in writing to the Architect, Engineer, District and DSA.

E. Retests: Where Unit Strength Tests and/or Masonry Prism tests indicate non-compliance with specified requirements, additional testing shall be performed on the wall areas in question, using either Prism Tests from Constructed Masonry per CBC 2105A.3 or Masonry Core Testing per CBC 2105A.4. The cost of such additional testing shall be the responsibility of the Contractor. Where retesting fails to indicate conformance with specified requirements, any masonry construction represented by unsatisfactory tests shall be removed and replaced with acceptable masonry construction.

**END OF SECTION**
SECTION 05 12 00
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SUMMARY

A. Extent of structural steel work is shown on drawings including schedules, notes and details that show size and location of members, typical connections, and type of steel required. Furnish all labor, materials, services, equipment and appliances required in conjunction with or related to the furnishing, fabrication, delivery, and erection of all structural steel defined below. Include all supplementary parts, members and connections necessary to complete the structural steel work, regardless of whether all such items are specifically shown or specified on the drawings.

B. Related Sections

1. Section 03 30 00 – Cast-in-Place Concrete
2. Section 05 50 00 – Metal Fabrications

1.3 DEFINITIONS

A. Structural Steel shall be defined as that work prescribed in Section 2.1 of the AISC “Code of Standard Practice for Steel Buildings and Bridges” and all other structural steel framing shown on the Structural Drawings.

1.4 QUALIFICATIONS

A. Fabricator:

1. The structural steel fabricator shall have not less than 5 years experience in the successful fabrication of structural steel similar to this project.

2. The structural steel fabricator must participate in one of the following certification programs. Program certification must be current at the time of bidding and throughout the duration of the project.

   a. The AISC Quality Certification Program and be designated an AISC Certified Plant in Category STD, Standard for Steel Building Structures.

   b. The Los Angeles Department of Building and Safety (LADBS) certification program.
3. The structural steel fabricator must be registered and approved by the local building official to perform fabrication work without special inspection.

B. Detailer:

1. The structural steel detailer shall have not less than 5 years experience in the successful detailing of structural steel similar to this project.

C. Erector:

1. The structural steel erector shall have not less than 5 years successful experience in the erection of structural steel of a similar nature to this project.

2. The structural steel erector must participate in one of the following certification programs. Program certification must be current at the time of bidding and throughout the duration of the project.
   
a. AISC Erector Certification Program and be designated an AISC Certified Steel Erector.
   
b. The Los Angeles Department of Building and Safety (LADBS) certification program.

D. Independent Testing Laboratory: Any testing laboratory retained to perform tests that are required by this specification shall meet the basic requirements of ASTM E329

1.5 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

A. Codes and Standards: Comply with provisions of following, except as otherwise indicated. For codes and standards for which no specific version is referenced, the version that is referenced in the applicable building code shall govern, or, if there is no reference in the building code, the latest version of the code or standard shall govern except as otherwise noted in the AISC Steel Construction Manual, 14th edition. Certain sections in this specification contain requirements that are more restrictive and/or different than contained in the standards listed. In such cases, the requirements of this specification shall control.

1. California Code of Regulations, Title 24, 2016 edition, also known as California Building Code (CBC), with Division of the State Architect (DSA) amendments.

2. All federal (OSHA), state and local laws that govern safety requirements for steel erection and other requirements if more stringent than the codes and standards enumerated below. OSHA requirements include regulation 29 CFR 1926, Part R, “Safety Standard for Steel Erection”.

a. Certain sections in this specification contain requirements that are more restrictive and/or different than contained in this standard. In such cases, the requirements of this specification shall control.


5. Research Council on Structural Connections (RCSC) "Specification for Structural Joints using High Strength Bolts".


7. ANSI/AWS D1.1 "Structural Welding Code - Steel.


9. ANSI/AWS D1.8 “Structural Welding Code – Seismic Supplement”


B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code - Steel".

C. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in the mill, shop, and field by the District's testing laboratory. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. The Contractor shall promptly remove and replace materials or fabricated components which do not comply.

D. Questions about Contract Documents: The Contractor shall promptly notify the Architect/Engineer whenever design of members and connections for any portion of the structure are not clearly indicated or when other questions exist about the Contract Documents. Such questions shall be resolved prior to the submission of shop drawings.

E. District’s Testing Laboratory Services: Inspection or testing by the District does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents

F. Surveyor: The General Contractor shall employ a qualified land surveyor to perform surveys required by this specification.

1.6 SUBMITTALS

A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products; include laboratory test reports and other data to show compliance with specifications (including the specified standards):

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties. For structural steel for which evidence exists that the steel may not conform to ASTM requirements, the contractor, where permitted by the engineer, shall engage the services of an independent testing laboratory to test the material according to ASTM A6 and submit certified test
reports that verify conformity to ASTM standards. Tests shall be made for each 10 tons of affected material unless otherwise directed by the Engineer.

2. Shrinkage-resistant grout.

3. Unfinished bolts and nuts.

4. Welding electrodes (each type).

B. Shop Drawings and Erection Drawings:

1. All drawings submitted for review shall have the approved shop drawing stamp of the Design Team as part of the title block. The approved shop drawing stamp will be provided in electronic format to the successful bidder.

2. Definitions:

   a. Shop Drawings: Drawings of the individual structural steel shipping pieces that are to be produced in the fabrication shop.

   b. Erection Drawings: Field-installation or member-placement drawings that are prepared by the Fabricator to show the location and attachment of the individual shipping pieces.

3. Shop Drawings: Submit for review and approval shop drawings showing complete details and schedules for fabrication and assembly of structural steel members. Structural steel shop drawings shall include the following minimum information:

   a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify the type of high-strength bolted connection (slip-critical, direct-tension, or bearing connections). Holes, flange cuts, slots and openings shall be made as required by the structural drawings, all of which shall be properly located by means of templates.

   b. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

   c. Structural steel shop and erection drawings shall identify:

      1. Locations where weld backing is to be removed
      2. Locations where fillet weld reinforcement is to be added to steel backing left in place
      3. Locations where weld tabs are to be removed
      4. Access hole dimensions, surface profile and finish requirements
      5. Locations of pre-tensioned bolts
      6. Connection material specifications and sizes
      7. Gusset Plates drawn to scale when they are detailed to accommodate inelastic rotation
      8. Non Destructive Testing (NDT) to be performed by the fabricator, if any
(9) Indicate joints or groups of joints in which a specific assembly order, welding sequence, welding technique or other special precautions are required

4. Erection Drawings: Submit for review and approval complete erection drawings showing field-installation and member-placing instructions for locating and attaching the individual shipping pieces.

5. The fabricator alone shall be responsible for all errors of detailing, fabrication, and for the correct fitting of the structural members.

6. All fabricated material and connections shall fit within architectural constraints.

7. Structural steel members for which shop drawings have not been reviewed and approved shall not be fabricated.

8. The omission from the shop drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though the shop drawings may have been reviewed and approved.

C. Surveys: Submit the information requested for all surveys required by this specification.

D. Test Reports: Submit certified reports of tests required by this Specification Section. Include data on type(s) of tests conducted and test results.

E. Qualification Data:

1. Submit qualification data, including required certifications, for firms and persons specified in the “Qualifications” section under Part 1, to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and Districts, and other information specified.

2. Submit Welding Procedure Specifications (WPS) in accordance with ANSI/AWS D1.1 for all welded joints. Submit test reports showing successful passage of qualification tests for all non-prequalified WPSs.

3. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests as specified in the “Qualifications” section under Part 1. If recertification of welders is required, retesting will be at Contractor's responsibility.

4. A fabricator that is registered with the local building official and is approved to perform fabrication without special inspection shall submit a certificate of compliance stating that the work was performed in accordance with the approved construction documents.

F. Substitutions:
1. Substitutions or any other modifications proposed by the Contractor will be considered by the Architect/Engineer only under the following conditions:

a. That the request has been made and accepted by the Architect/Engineer and approved by DSA prior to the submission of shop drawings. All substitutions shall be clearly marked and indicated on the shop drawings as a substitute.

b. That there is a substantial cost advantage or time advantage to the District; or that the proposed revision is necessary to obtain the required materials or methods at the proper times to accomplish the work in the time scheduled.

c. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect/Engineer, including cost reductions or savings in time to complete the work.

d. The contractor agrees to compensate the Architect and Engineer of Record for all labor and expenses associated with reviewing substitutions, including obtaining approval from DSA.

e. In no case shall such revisions result in additional cost to the District.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor rods and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. Do not store materials on structure in a manner that might exceed allowable loads on or cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed by Architect/Engineer.

D. Furnish all fuel, maintenance, and equipment required for hoisting and placement of materials under this contract.

E. Process, pay for and maintain all permits and certificates of on-site inspection required for derricks, cranes and hoisting equipment. No derrick, crane or hoisting equipment shall be operated without a certificate of operation and a certificate of on-site inspection, as required by governing authorities.

1. In addition to the above, all hoisting equipment shall be installed, operated and maintained in accordance with all applicable regulations of authorities having jurisdiction.

2. The Contractor shall furnish street storage and sidewalk crossing permits.
1.8 JOB CONDITIONS

A. The Contractor shall coordinate the fabrication and erection of all structural steel work with the work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel: All hot rolled steel plates, shapes, sheet piling, and bars shall be new steel conforming to ASTM A6.

B. Structural steel shall comply with the provisions of the following ASTM Specifications as appropriate for the grades and types, and at the locations as specified on the drawings:

1. Structural Steel Wide Flange and WT Shapes - High Strength Steel, ASTM A992.
2. Channels - ASTM A36.
4. Structural Steel Plates and Bars - ASTM A36 typical; ASTM A572 Grade 50 where noted.
5. Steel Pipe - ASTM A53 (Type E or S) Grade B (Fy = 35 ksi).
6. Square and Rectangular HSS – ASTM A500, Grade B/C (Fy = 46 ksi).
7. Round HSS – ASTM A500, Grade B/C (Fy = 42 ksi)
8. Connection Material: Unless noted otherwise on the drawings, all connection material including bearing plates, gusset plates, stiffener plates, filler plates, angles, etc. shall be A36 steel unless an alternate grade of steel with the members connected is specified.

C. Structural Steel Surfaces: For fabrication of work which will be exposed to view in the completed structure, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

D. Structural Bolts and Threaded Fasteners: Structural bolts and threaded fasteners shall comply with the following ASTM Specifications as appropriate for the types and at the locations as specified on the drawings:

1. ASTM A325 Type 1.
2. Alternative Design Fasteners: Fasteners that incorporate a design feature intended to indicate a predetermined tension or torque (load indicator bolts or “twist-off”)
bolts) shall conform to the requirements of section 2.8 of the RCSC “Specification for Structural Joints Using ASTM A325 or A490 Bolts”.

a. Bolts that are manufactured to conform to ASTM A325 shall additionally conform to ASTM F1852.

b. Subject to conformance with specified requirements, acceptable manufacturers include but are not limited to:

   1. Nucor Fastener, A Division of Nucor Corporation, Conway, AR and St. Joe, IN.
   2. Lake Erie Screw Corp., Lakewood, OH.
   3. Vermont Fasteners Manufacturing, Swanton, VT.
   4. Lohr Structural Fasteners, Humble TX.


4. Bolts and Nuts, High Strength Bolts: Bolts and nuts for all high strength bolts shall be heavy hex head conforming to ANSI Standards B18.2.1 and B18.2.2 respectively. Nuts shall conform to ASTM A563.

5. Washers: All washers shall be circular, flat and smooth and shall conform to the requirements of Type A washers in ANSI Standard B23.1. Washers for high strength bolts shall be hardened and conform to ASTM F436. Beveled washers for American Standard Beams and channels shall be square or rectangular, shall taper in thickness (16 2/3% slope) with an average thickness of 5/16”. When an outer face of a bolted part has a slope greater than 1:20 with respect to a plane normal to the bolt axis, a beveled washer shall be used.

6. Zinc-Coated Bolts: ASTM A325 bolts, with their nuts and washers, that are used to connect steel specified as hot-dip galvanized after fabrication shall be zinc-coated either by the hot-dip process in accordance with ASTM A153, Class C or by the mechanical deposition process in accordance with ASTM B695, Class 50, Type 1. The bolts, nuts, and washers shall all be zinc-coated using the same process and they shall be considered together as an assembly and shall be tested and shipped together as such. Comply with all the requirements of ASTM A325 and ASTM A563 as they relate to zinc-coated materials. ASTM F1852 bolts with their nuts, and washers shall be zinc-coated only by the mechanical deposition process in accordance with ASTM B695, Class 50, Type 1. Do not zinc-coat ASTM A490 bolts.

7. Direct Tension Indicators: Compressible washer-type direct-tension indicators conforming to ASTM F959.

   Subject to conformance with specified requirements, acceptable manufacturers include but are not limited to:

   Applied Bolting Technology, Ludlow, VT
   Turnasure, LLC. Langhorne, PA

8. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed.
9. New Bolts: All bolts shall be new and shall not be reused.

E. Electrodes for Welding:

1. Provide electrodes that comply with AWS D1.1, "Structural Welding Code - Steel" and that can produce welds that have a minimum Charpy V-notch toughness of 20 ft-lbs at 40° F, unless noted otherwise in these specifications or on the drawings.

2. Electrodes for various welding processes shall be as specified below:
   a. SMAW - E70XX low hydrogen
   b. SAW: - F7X-EXXX
   c. GMAW: - ER70S-X
   d. FCAW: - E7XT-X

3. Electrodes shall be compatible with parent metal joined.

F. Shear Connectors (Headed and Threaded Studs): Shear connectors and their installation shall meet all requirements specified in Section 7, Type B of AWS D1.1 "Structural Welding Code-Steel". Sizes of shear connectors shall be as specified on the drawings.

G. Anchor Rods:

1. All anchor rods shall conform to ASTM F 1554 unless noted otherwise on the drawings and shall be of the yield strength as specified on the drawings:
   a. Grade 36 typical, additionally conforming to Supplementary Requirement S1 of ASTM F 1554. Substitution for Grade 36 anchor rods with Grade 55 anchor rods shall only be permitted provided the Grade 55 anchor rods comply with Supplementary requirements S1 of ASTM F1554.

2. Anchor rods used with galvanized base plates shall be galvanized.

3. Nuts: All nuts with anchor rods shall be heavy hex head conforming to ASTM A563.

4. Washers: Unless indicated otherwise, washers for all base plates shall be in accordance with the AISC “Steel Construction Manual”, Table 14-2 with holes 1/16” larger than the anchor rod diameter. Washers shall conform to ASTM A36 steel.

H. Structural Steel Primer Paint:

1. Unless noted otherwise, primer paint shall be the following with the indicated surface preparation:
   a. SSPC-Paint 25.1, Type II; zinc oxide, raw linseed oil and alkyd primer, surface prepared according to SSPC-SP-2 (Hand Tool Cleaning) unless noted otherwise in this specification.
2. Refer to Architect's drawings and specifications for final paint finish requirements of structural steel. Primer paint shall be compatible with finish paint requirements.

I. Non-Shrink Grout: Provide grout type(s) as specified on the drawings:

1. Non-Metallic Non-Shrink Grout: Premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents, and fluidity improving compounds. Conform to ASTM C1107. Provide 8000 psi minimum compressive strength as determined by grout cube test at 28 days.

Subject to conformance with specified requirements, acceptable non-shrink grouts include:

"Crystex" and “Duragrout” as manufactured by L&M Construction Chemicals, Inc.

"Sure Grip High Performance Grout," and “1107 Advantage Grout” as manufactured by Dayton-Superior Corporation.

"Masterflow 555", and "Set Grout" as manufactured by BASF Construction Chemicals.

"Five Star Grout" as manufactured by U.S. Grout Corp.

"NS Grout" as manufactured by The Euclid Chemical Company.

“CG 200 PC”, Hilti, Inc.

J. Hot Dip Galvanizing:

1. Scope: All structural steel items and their connections permanently exposed to exterior conditions or that are within areas of unconditioned airspace, whether specified on the drawings or not, shall be hot-dipped galvanized after fabrication unless indicated on the drawings or in Specification Section 09900 to receive a primer and/or finish coat. Such items include, but are not limited to:

a. Base plates and anchor rods supporting galvanized members shall also be galvanized.

b. Trash Enclosure members.

c. Screen wall and Exterior Canopy supporting members.

Examine the architectural and structural drawings for other items required to be hot dipped galvanized.

Zinc-coat all ASTM A307 and A325 bolts nuts, and washers used in the connection of such steel. Field welded connections shall have welds protected with galvanizing repair paint.
2. Surface Preparation: All steel to be hot dip galvanized shall undergo the following surface preparation as specified by the Steel Structures Painting Council (SSPC), Volume 2.
   a. Remove all grease, oil, grime and foreign contaminants by thorough cleaning with an alkaline or organic solvent followed by thorough rinsing in cold water.
   b. Remove scale by pickling in diluted sulfuric or hydrochloric acid. Pickling shall be followed by a rinse in warm water and a second rinse in cold water. As an alternative to pickling, the steel may be white metal blast cleaned according to SSPC-SP-5.
   c. Dip in a flux solution of zinc ammonia chloride followed by drying at room temperature.

3. Zinc Coating: The zinc coating for steel shapes and plates shall conform to ASTM A123. Weight of zinc coating per square foot of surface for 1/8 inch and 3/16" thick steels shall average not less than 2.0 oz. with no individual thickness less than 1.8 oz. The coating weight shall average not less than 2.3 oz. with no individual thickness less than 2.0 oz. for 1/4" thick and heavier steel.

K. Galvanizing Repair Paint: Galvanizing repair paint shall be "ZRC Cold Galvanizing Compound" as manufactured by ZRC Chemical Products or a paint complying with SSPC-Paint 20.

2.2 FABRICATION

A. Shop Fabrication and Assembly:
   1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specification and as indicated on approved final shop drawings. Provide camber in structural members where indicated. Fabricator shall coordinate connection details, joint fit-up procedures, and field adjustment requirements with erector. The General Contractor shall coordinate provision of all erection bolts, lifting lugs or other devices required for erection with the fabricator and the erector and for interference with architectural finishes and constraints.

   2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

   3. Clearly mark the grade of steel on each piece, distinguishable in the field from floor surfaces, for purpose of field inspection and confirmation of grade of steel.

   4. Milled surfaces of built-up sections shall be completely assembled or welded before milling.

   5. Fitted stiffeners shall be fabricated neatly between flanges, and the ends of stiffeners shall be milled or ground to secure an even bearing against abutting surfaces. All milled or ground joints shall bear throughout their contact length.
B. Dimensional Tolerances: Dimensional tolerances of fabricated structural steel shall conform to Section 6.4 of the AISC Code of Standard Practice.

C. Splices in Structural Steel: Splicing of structural steel members in the shop or the field is prohibited without prior approval of the Engineer. Any member having a splice not shown and detailed on approved shop drawings will be rejected.

D. Compression Joints: Ends of columns, except as otherwise noted, and other compression joints at splices and other connections as noted on the drawings which depend on contact bearing as part of the splice strength shall be finished to bear in accordance with AISC Specification M2.6 so as to provide complete true bearing in accordance with AISC Specification M4.4.

E. Cutting: Manual oxygen cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is not within 1/8 inch of the finished dimension and final removal is completed by means such as chipping or grinding to produce a smooth surface quality free of notches or jagged edges. All corners shall be smooth and rounded to a minimum 1/2" radius.

F. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members as shown on the contract documents, and/or the final shop drawings.

1. Provide specialty items as indicated to receive other work.

2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

G. Lifting and Erection Devices: The fabricator shall be responsible for designing, detailing and furnishing all lifting devices and erection aids required for erection. Such devices shall be removed after erection if they interfere with architectural finish requirements.

H. Drainage Holes: Provide 1 inch diameter drainage (weep) holes in all members (trusses, girders, beams, etc.) exposed to weather where rain water could collect (at low points and/or behind dams caused by connections, stiffener plates, etc.). Show all holes on shop drawings for review by the Engineer.

2.3 WELDING

A. Code: All shop and field welding shall conform to all requirements in the "Structural Welding Code - Steel", ANSI/AWS D1.1, as published by the American Welding Society (AWS). In addition for projects required to meet the AISC Seismic Provisions for Structural Steel Buildings the provisions of AWS D1.8 shall supplement the provisions of AWS D1.1 where specifically modified by AWS D1.8 and shall apply to the design, fabrication, quality control and quality assurance of welded joints designed in accordance with the AISC Seismic provisions for Steel Buildings.

B. Welder Certification: All shop and field welders shall be certified according to all the applicable AWS procedures for the welding process and welding position used. Each welder shall be assigned an identifying symbol or mark and all shop and field welded
connections containing complete or partial joint penetration welds, multi-pass fillet welds, and fillet welds greater than 5/16” shall be identified by the symbol or mark of the welder responsible for the connection.

C. Minimum Size and Strength:

1. Fillet Welds: Minimum size of fillet welds shall be as specified in Table J2.4 in AISC Specification, Chapter J.

2. Partial-Penetration Groove Welds: The minimum effective throat thickness of partial-penetration groove welds shall be as specified in Table J2.1 in AISC Specification, Chapter J.

3. Minimum Strength of Welded Connections: Except as specified below in "Connections" or noted otherwise on the drawings, all shop and field welds shall develop the full tensile strength of the member or element joined. All members with moment connections as indicated on the drawings shall be welded to develop the full flexural capacity of the member, unless noted otherwise on the drawings.

D. Filler Metal Requirements: Weld metal shall be as specified in Table J2.5 in AISC Specification, Chapter J and other requirements of this specification.

E. Welding Procedure Specification:

1. All welding shall be performed in accordance with a Welding Procedure Specification (WPS) as required in AWS D1.1 and approved by the District’s Testing Laboratory and the Architect/Engineer. The WPS variables shall be within the parameters established by the filler-metal manufacturer. Engage the services of an independent testing laboratory, DSA approved, to provide the qualification testing required by AWS D 1.1, chapter 4, part B to qualify any non-prequalified WPS needed for the project. The testing laboratory shall prepare Welding Procedure Qualification Records (WPQR) documenting the successful qualification of each Welding Procedure Specification.

F. Welding Procedures:

1. All welding processes shall comply with the requirements of ANSI/AWS D1.1 unless noted otherwise.

2. Complete joint penetration welds of beam bottom flanges to column, or to continuity plates shall be sequenced to conform to the requirements of AWS D1.8, Section 6.14.

3. Built-up sections assembled by welding shall be free of warpage and all axes shall have true alignment.

4. Welds not specified shall, if possible, be continuous fillet welds developing the minimum strength, as specified above, using not less than the minimum fillet welds as specified by AISC.
5. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.

6. Before welding is started, the fabricator shall submit for the approval of the District's Testing Laboratory in consultation with the Architect/Engineer, written Welding Procedure Specification for all joints to be welded. After approval, the Welding Procedure Specification shall be followed without deviation unless specific approval for change is obtained from the District's Testing Laboratory and the Architect/Engineer.

7. Before welding, particular attention shall be paid to surface preparation, fit up and cleanliness of surfaces to be welded.

8. Minimum preheat and interpass temperatures for structural steel welding shall be as specified in ANSI/AWS D1.1 and D1.8, except that no welding shall be performed when the ambient temperature is lower than 0 degrees F. The temperature shall be measured from the side opposite that upon which the preheat is applied.

9. The heat, input, length of weld and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.

10. Welds shall be sound throughout. There shall be no crack in any weld or weld pass. Welds shall be considered sound if they conform to AWS requirements, as confirmed by non-destructive testing.

11. Welds shall be free from overlap.

12. Craters shall be filled to the full cross section of the welds.

13. Fabricator and erector shall coordinate welding responsibility at all welded joints.

G. Stress Relieving: All welding sequences shall be such as to reduce the residual stresses due to welding to a minimum value. If high residual stresses are present, stress relieving of joints shall be required. Welded connections shall be detailed and designed to minimize the accumulation and concentration of through-thickness strains due to weld shrinkage.

2.4 BOLTING

A. Bolt Diameter: Minimum bolt diameter shall be 7/8 inch unless noted otherwise.

B. Connection Type: Unless noted otherwise on the drawings, all bolted connections shall be snug-tightened using high-strength bolts in standard holes (hole diameter nominally 1/16 inch greater than the nominal bolt diameter) with threads included in the shear planes. Notwithstanding, the contractor shall be responsible to adhere to provisions of AISC Specification Section J1.10, which lists circumstances under which certain connections require pretensioned high strength bolts.
C. Oversize, Short Slotted and Long Slotted Holes: The dimensions and washer requirements of oversize, short slotted, and long slotted holes shall conform to the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

D. Fastener Tension:

1. High strength bolts in snug-tightened joints shall be tightened to a snug tight condition only. Do not pretension bolts in snug-tightened joints the same as if they were in slip-critical joints. The snug-tightened condition is defined as the tightness that exists when all plies are in firm contact. This may usually be attained by a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench.

2. High-strength Bolts in Slip-Critical and Pretensioned Joints:
   
   a. High-strength bolts in slip-critical and pretensioned joints shall be tightened to achieve the minimum bolt tension as specified in the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts" when all the fasteners of a joint are tight.

   b. Any of the four methods to tighten bolts specified in the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts" may be used to achieve the minimum bolt tension. The tightening procedure that uses direct tension indicator washers shall conform to the requirements of ASTM F959.

   c. The Contractor shall cooperate with the District’s Testing Laboratory when Arbitration Testing and Inspection is called for due to a disagreement regarding the tension in installed bolts that have been inspected according to the Testing and Inspection portion of this specification section.

E. Washers: Washers under the bolt head and/or nut shall be used as required by the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

F. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed.

G. Impact Wrenches: Properly sized and lubricated air impact wrenches with adequate air pressure shall be utilized for all bolt installation.

H. New Bolts: All bolts shall be new and shall not be reused.

2.5 CONNECTIONS

A. Connection details are indicated on the drawings.

B. Base Plates and Bearing Plates:

1. Finish: All baseplates and bearing plates shall be finished in accordance with AISC Specification M2.8.
2. Attachment to Column: Unless shown otherwise on the drawings, all baseplates and bearing plates shall be welded all around to the column with minimum fillet welds as specified in AISC Specification Table J2.4.

3. Anchor Rod Holes in Baseplates: Hole sizes in baseplates for anchor rods shall be made oversize as described in the AISC “Steel Construction Manual”, Table 14-2.

C. Stiffeners: Provide stiffeners finished to bear under load concentrations where shown on the drawings.

D. Limitations on Use of A307 Bolts: ASTM A307 bolts shall not be used in any permanent steel-to-steel or concrete-to-steel connection.

E. Bolts in Combination with Welds: Bolts shall not be considered as sharing the load in combination with welds, except as allowed in AISC Specification Section J1.8.

2.6 SURFACE PREPARATION AND SHOP PRIME PAINTING


B. Scope: All steel shall remain unpainted, except the following:

1. Shop prime paint surfaces that are to remain exposed to view in the final construction.

2. Shop paint any steel that, in the final construction, will not be in a controlled environment and is therefore subject to moisture or high humidity infiltration and that has not been specified to be galvanized.

3. Shop paint any steel that is shown on the drawings to receive a finished paint system as defined in Specification Section 09 90 00.

4. Coordinate all shop painting of structural steel with Architect's painting requirements as specified on the architectural drawings and in the specifications. The Fabricator shall be responsible for determining all painting requirements (which surfaces are to be painted or left unpainted) on the project prior to fabrication.

C. Additional Painting Requirements

1. Extend shop paint to 2" from location of welds on surfaces that are to be field welded.

2. If individual elements (including the mating surfaces) of an assembly that is required to be painted are painted prior to welding into an assembly, then all painted surfaces affected by welding shall be touched-up and repaired (according to manufacturer’s instructions, if any) to prevent corrosion bleeding.
3. The fabricator shall be responsible to ensure that all elements of all assemblies that are to be painted are fabricated so that no exposed surface shall be subject to stains due to corrosion bleeding during the warranty period of the paint.

D. Surface Preparation - Unpainted Steel: All structural steel that is not specified to receive a shop coat of primer paint shall be prepared in accordance with Society for Protective Coatings specifications as follows:

1. SSPC-SP 2, “Hand Tool Cleaning” or SSPC-SP 3, “Power Tool Cleaning” unless otherwise specified.

E. Surface Preparation and Primer Paint - Shop Painted Steel:

1. Surface Preparation: Prepare the surface of all structural steel specified to be shop painted as required by the paint manufacturer or the Society for Protective Coatings specifications, but not less than the following:
   a. SSPC-SP 2, “Hand Tool Cleaning” or SSPC-SP 3, “Power Tool Cleaning” unless otherwise specified.

2. Priming: Immediately after surface preparation, apply primer to all structural steel specified to be shop primed in strict accordance with manufacturer’s instructions and the Society for Protective Coatings specifications. Apply paint at a rate to conform to the manufacturer’s written instructions and to provide a dry film thickness of not less the 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, welds, and all exposed surfaces. Apply two coats to surfaces that are inaccessible after assembly or erection. Change the color of the second coat to distinguish it from the first coat.

3. Finish Coat: Coordinate shop primer paint requirements with architectural drawings and specifications. The primer selected must be compatible with any specified finish coat.

F. Shop Touch-Up Painting: The Fabricator shall provide for cleaning and touch-up painting of welds, bolted connections (including nuts, bolts, washers, filler plates, member end supplement plates and welds, if any), and abraded areas. Prior to shipment, apply paint to exposed areas using same materials and surface preparation as used for shop painting. Paint shall be applied by brush or spray with minimum dry film thickness of 1.5 mils.

2.7 SOURCE QUALITY CONTROL

A. The District’s Testing Laboratory shall:

1. Review ladle analysis and mill test reports. Where certification is questionable, test material to verify compliance per CBC 2203A.1.

2. Visually inspect the seam welds of HSS hollow structural steel sections for visible discontinuities. Include the exterior of the seam weld and the interior at each end of the HSS member.
B. Inspect shop fabrication per CBC Section 1705A.2.

PART 3 - EXECUTION

3.1 ERECTION

A. The Erection work shall comply with the requirements of AISC Specification Section M4.

B. Inspection: Erector shall examine areas and conditions under which structural steel work is to be installed and notify the Contractor and the Architect/Engineer in writing of conditions detrimental to proper and timely completion of the work.

C. Check elevations of concrete and masonry bearing surfaces and anchor bolt locations prior to erection and submit any discrepancies to the Engineer prior to the start of erection. Corrections or compensating adjustments to the structural steel shall be made and approved prior to the start of erection.

D. Erection Tolerances: Erection tolerances of anchor rods, embedded items, and all structural steel shall conform to the AISC Code of Standard Practice, Section 7, unless stricter tolerances are specified elsewhere in the contract documents.

E. Temporary Shoring and Bracing:

1. Comply with the provisions of the AISC Code of Standard Practice regarding stability of the structure during the erection process, except where stricter requirements are noted herein.

2. The Erector shall design and provide all required temporary shoring and bracing to hold structural framing securely in position and to safely withstand all loads as specified in the AISC Code of Standard Practice and ASCE 37 unless larger loads are required by the local building code or specified herein. Provide all bracing, any additional structural members, and increase member sizes and/or connections shown on the drawings as required to accommodate the erection loads, methods, sequence of erection, and equipment until the lateral-load resisting or stability-providing system is completely installed. Clearly show all temporary supports and modifications to designed members on the Shop Drawings.

3. Where architectural or MEP requirements do not allow for any temporary supports, members, erection devices, or connections to be left in place permanently or where such items affect the final structural behavior, they shall be removed by the erector. All costs associated therewith shall be included in the bid price.

F. Wherever the erection equipment is supported by the structure, the Contractor shall be responsible for the retention of a licensed professional engineer to determine the adequacy of the member supporting the erection equipment in relation to the loads imposed thereon.

G. Anchor Rods: Furnish anchor rods and other connectors required for securing structural steel to foundations and other in-place work. Furnish 1/8” minimum steel templates for presetting bolts and other anchors to accurate locations. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims,
but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout. Use only steel wedges or shims.

H. Base Plates and Bearing Plates: Remove loose latent material from bearing surfaces and base and bearing plates. Set plates to the elevation indicated on the drawings and level using steel shims (plastic shims will not be allowed) or by three leveling screws with weldments at the plate edges. After all protruding plates have been trimmed, grout plates solidly between bearing surfaces using the specified grout, ensuring no voids are present. Finish exposed surfaces, protect installed materials, and allow to wet cure. For proprietary grout materials, comply with manufacturer's instructions. Tighten anchor bolts after supported members have been positioned and plumbed.

I. Splices: Splices will be permitted only where indicated on the DSA approved structural drawings and approved shop drawings. Fastenings of splices of compression members shall be done after the abutting surfaces have been brought completely into contact within AISC tolerances. Bearing surfaces and surfaces that will be in permanent contact are to be cleaned before the members are assembled.

J. Field Assembly of Structural Steel:

1. As erection of the steel progresses, the work shall be fastened securely to safely carry all dead load, wind and erection forces. Particular care shall be exercised to ensure straightness and tautness of bracing immediately upon raising a steel column.

2. Provide temporary planking and working platforms as necessary to effectively complete work.

3. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified AISC tolerances. The Contractor shall coordinate with Erector and Fabricator regarding possible discrepancies in member lengths between temperature at time of fabrication and temperatures during erection, and shall make necessary adjustments to ensure plumbness within AISC tolerances at 70°F. Compensate for cumulative welding draw, construction loadings, sequential applications of dead loads, or any other predictable conditions that could cause distortions to exceed tolerance limitations.

4. On welded construction exposed to view or weather, remove erection bolts, fill holes with plug welds or filler and grind smooth at exposed surfaces.

5. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces receiving field welds.

6. Comply with all bolting and welding requirements of Part 2 of this specification section.
7. Fillers and shims shall not exceed ¼” thick unless approved by the Structural Engineer and DSA.

K. Field Modifications to Structural Steel: Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and structural fitting of parts shall be reported immediately to the Architect/Engineer, and approval of the method of correction shall be obtained. Approved corrections shall be made at no additional cost to the District. Do not use cutting torches, reamers, or other devices in the field for unauthorized correction of fabrication errors.

L. Miscellaneous Framing: Provide supplemental structural steel support framing for steel deck where columns, or other framing members or floor openings interrupt normal deck bearing whether shown or not on the architectural, mechanical, or structural drawings.

M. Removal of Erection Aids and Devices: The erector shall remove all erection aids and devices that interfere with architectural finish or MEP requirements.

N. Field Touch-Up Painting:

1. Clean field welds, unpainted areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any shop painted areas that are abraded. Apply paint to all exposed areas using same material and surface preparation as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

2. Clean field welds, ungalvanized areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any galvanized areas that are abraded. Prepare surfaces and apply specified galvanizing repair paint in accordance with ASTM A780.

3. The Contractor shall ensure that, at the substantial completion of the project, all structural steel, bolted and/or welded, required to be painted shall have all necessary steel surfaces painted (including touch-up painting as required) to prevent corrosion bleeding.

O. Clean Up

1. Clean up all debris caused by the Work of this Section, keeping the premises neat and clean at all times.

2. After erection, thoroughly clean surfaces of foreign or deleterious matter such as dirt, oil or great that would impair the bonding of concrete or other finishes as applicable.

3.2 FIELD QUALITY CONTROL

A. The District will engage a special inspector and qualified testing and inspection agency (the Testing Laboratory) approved by DSA to perform field tests and inspections and prepare test reports.
B. Scope of Work

1. The District’s Testing Laboratory: An independent testing laboratory will sample and test materials as they are being installed for compliance with acceptance criteria as specified and report and interpret the results. The laboratory shall monitor and report on the installation of constructed work and shall perform tests on the completed construction as required to indicate Contractor’s compliance with the various material specifications governing this work. The District shall be responsible for paying the testing laboratory for these services.

2. The District’s Testing Laboratory or a separate agency shall serve as a Special Inspector to provide Special Inspection services for the items listed below. The scope of such services for each item shall be as defined in the CBC 2016. These inspections are mandatory for conformance to the legal requirements of the building code and shall be in addition to the inspections and tests otherwise defined in this specification.

C. Special Inspections:

1. Inspection of Structural Steel, Bolting, and Welding Material
2. Welding of Structural Steel
3. High-Strength Bolting

D. Qualifications

1. Qualifications of Special Inspector: The special inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of DSA, for inspection of the particular type of construction or operation being inspected. The Special Inspector shall meet the legal qualifications of the 2016 California Code of Regulations.

2. Testing Laboratory
   a. The Testing Laboratory shall meet the basic requirements of ASTM E329 and shall submit to the District, Architect, and Engineer evidence of current accreditation from the American Association for Laboratory Accreditation, the AASHTO Accreditation Program or the “NIST” National Voluntary Laboratory Accreditation Program.
   b. The Testing Laboratory shall be an Approved Agency by the Building Official of the city wherein the project is located to perform Special Inspections and other tests and inspections as outlined in the applicable building code.
   c. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

3. Qualifications of Welding Inspectors
a. Inspectors performing visual weld inspection shall meet the requirements of AWS D1.1 Section 6.1.4. Welding inspection shall be supervised and the inspection reports signed by an inspector with current certification as an AWS Certified Welding Inspector (CWI)

b. Inspectors performing nondestructive examinations of welds other than visual inspection (MT, PT, UT, RT) shall meet the requirements of AWS D1.1, Section 6.14.6.

E. Authorities and duties of the District’s Testing Laboratory:

1. Attend Preconstruction Conferences: The District’s Testing Laboratory shall receive from the District and review the project plans and specifications with the Architect and Engineer immediately upon receipt and prior to the start of construction. The Laboratory shall attend preconstruction conferences with the Architect, Engineer, Project Manager, IOR, General Contractor, and Material Suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule and shall participate in such conferences throughout the course of the project.

2. Cost Proposal: The Testing Laboratory's proposal to the District shall contain unit price stipulations for specified tests and inspections and on an hourly basis for personnel. A total estimated price shall also be submitted.

3. Cooperation with Design Team: The Laboratory shall cooperate with the Architect, Engineer, and Contractor and provide qualified personnel promptly on notice.

4. The Laboratory shall perform the required inspections, sampling, and testing of materials as specified under each section and observe methods of construction for compliance with the requirements of the Contract Documents and the 2010 CBC.

5. Inspections Required by Government Agencies: The Testing Laboratory shall perform inspections and submit reports and certifications as required by government agencies having jurisdiction over the aspects of the project covered by this specification.

6. Notification of Deficiencies in the Work: The Laboratory shall notify the Architect, Engineer, IOR and Contractor within 24 hours of discovery by telephone or e-mail, and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.

7. Reports:

   a. Information on Reports: The Laboratory shall submit copies of reports of inspections and tests promptly and directly to the parties named below. The reports shall contain at least the following information:

      (1) Project Name and DSA Application number
      (2) Date report issued
      (3) Testing Laboratory name and address
(4) Name and signature of inspector  
(5) Date of inspection and sampling  
(6) Date of test  
(7) Identification of product and Specification section  
(8) Location in the project  
(9) Identification of inspection or test  
(10) Record of weather conditions and temperature (if applicable)  
(11) Results of test regarding compliance with Contract Documents  

b. Copies: The Laboratory shall send signed copies of test and inspection reports to the following parties:  

(1) Copies of Reports to the District or his representative  
(2) Copies of Reports to General Contractor  
(3) Copies of Reports to Architect  
(4) Copies of Reports to the Engineer of responsibility  
(5) Copies to the Inspector of Record (IOR)  

c. Certification: Upon completion of the job, the Laboratory shall furnish to the District, Architect, and Engineer of Record, a statement signed by a licensed professional engineer that, to the best of their knowledge, required tests and inspections were made in accordance with the requirements of the Contract Documents.  

8. Accounting: The Testing Laboratory shall be responsible for separating and billing costs attributed to the District and costs attributed to the Contractor.  

9. Monitoring Product and Material Certifications: The Testing Laboratory shall be responsible for monitoring the submittals of product and material certifications from manufacturers and suppliers as specified in the Specifications and shall report to the District, Architect, and Engineer when those submittals are not made in a timely manner.  

10. Limitations of Authority: The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors  

F. Contract Obligations:  

1. District Responsibility: The District shall pay for initial shop and field inspections and tests (laboratory services) as required during the fabrication and erection of the structural steel. The Contractor will be liable to the District for the cost for testing and retesting of materials that do not comply with the requirements of the Contract Documents and shall furnish and pay for the testing and inspection of other items as specified in these Specifications.  

2. Contractor Responsibility: The Contractor shall provide the Testing Laboratory with the following:
a. A complete set of shop and erection drawings that have been reviewed by the Architect/Engineer and including all revisions and addenda.
b. Cutting lists, order sheets, material bills, shipping bills, and mill test reports.
c. Information as to time and place of all rollings and shipment of material to shop.
d. Representative sample pieces requested for testing.
e. Full and ample means and assistance for testing all material.
f. Proper facilities, including scaffolding, temporary work platforms, hoisting facilities, etc, for inspection of work in the mills, shop, and field.

3. Testing Laboratory Responsibility: The inspection by the Testing Laboratory of the Fabricator’s work shall be in sequence, timely, and performed in such a manner so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years experience in structural steel testing and inspection. See "Qualifications of Welding Inspectors" above for special requirements for welding inspectors. The Testing Laboratory shall provide test reports of all inspections. All test reports shall indicate types and locations of all defects found during inspection, the measures required and performed to correct such defects, statements of final approval of all welding and bolting of shop and field connections, and other fabrication and erection data pertinent to the safe and proper welding and bolting of shop and field connections. In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of all test reports.

4. Duties and Responsibilities of the Special Inspector

a. The special inspector shall observe the work assigned to ascertain, to the best of his/her knowledge, that it is in conformance with the approved design drawings and specifications.
b. The special inspector shall keep records of inspections and shall furnish inspection reports to the DSA, the Architect/Engineer, and the District. All discrepancies shall be brought to the immediate attention of the Architect/Engineer, Contractor, and District. A report that the corrected work has been inspected shall be sent to the Architect/Engineer, and the District.
c. The special inspector shall create and maintain a log of all discrepancies throughout the duration of the project. This log shall include, but is not limited to the discrepancy date, description of the discrepancy, plans or views or specification reference, description of as-built condition, description of any remedial work performed and status of the discrepancy. This log shall be submitted to the contractor and Architect/Engineer on a periodic basis for review and comment. Upon completion this log shall be submitted as an entirety as an attachment to the final signed report described below.
d. The special inspector shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector’s knowledge, in conformance to the approved plans and specifications and the applicable workmanship provisions of the building code.
5. Rejection of Material or Workmanship: The District, Architect, Engineer, and Testing Laboratory reserve the right to reject any material or workmanship not in conformance with the Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.

G. Shop Inspections and Tests: The District’s Testing Laboratory shall provide the following inspections at the designated fabrication shops:

1. Shop Inspection Waiver: The requirement to perform fabricating shop inspection may be waived if the Fabricator produces evidence from the Building Official of being a registered, approved fabricating shop and if allowed by the Engineer.

2. An initial shop inspection prior to the start of any fabricating work shall be made to accomplish the following:
   a. Verify the fabrication shop’s certification from AISC.
   b. Verify the fabricator’s fabrication and quality control procedures provide a sound basis for inspection control of workmanship and of the ability to conform to construction documents and industry standards. Review the procedures for completeness and adequacy relative to code requirements for the fabricator’s finished product.
   c. Perform steps 1, 2 and 3 of the section "Weld inspection and Testing" described below when shop welding is to be performed.
   d. Perform step 1 of the section "High-Strength Bolting Inspection and Testing" described below when shop bolting involving joints that are designated on the plans as Pretensioned or Slip-Critical is to be performed.
   e. Provide periodic verification of specified camber of steel beams in the unstressed condition.
   f. For seam welds in hollow structural sections (HSS), conduct a thorough visual examination of the seam weld area for visible discontinuities. Visual examination should include, as a minimum, the exterior of the seam weld and the interior at each end.

3. Process Monitoring:
   a. Provide continuous monitoring of welding for all CJP,PJP, Plug and Slot welds, Multipass fillet welds and Single-pass fillet welds greater than 5/16 inch as described below in the Weld Inspection and Testing section.
   b. Periodically monitor welding of single-pass fillet welds that are less than or equal to 5/16 inch.
   c. Periodically monitor welding floor and roof deck welds.
   d. Provide continuous monitoring of high-strength bolt installation in pretensioned or slip-critical joints using turn-of-the-nut without matchmarking or calibrated wrench method of bolt installation.
   e. Periodically monitor high-strength bolt installation in snug-tight joints and in pre-tensioned or slip-critical joints using turn-of-nut with matchmarking, twist-off-bolt or direct tension indicator methods of installation.
H. Field Inspections: The District’s Testing Laboratory shall provide the following inspections in the field:

1. Obtain the planned erection procedure, and review with the Erectors supervisory personnel.
2. Check the installation of base plates for proper leveling, grout type, and grout application.
3. Verify that surveys are occurring as specified to check plumbness and frame alignment as erection progresses. Review the submitted survey report.
4. Conduct welding inspection and verification testing per detailed requirement of section on Welding Inspection and Testing below.
5. Conduct high-strength bolting inspection per detailed requirements of Section on High-Strength Bolting and Testing below.
6. Periodically inspect the steel frame for such items as bracing and stiffening details, member locations, and joint details at each connection for compliance with approved construction documents.
7. Endeavor to guard the District against the Contractor cutting, grinding, reaming, or making any other field modification to structural steel without the prior approval of the Engineer. Report any noted unauthorized modifications to the District and Engineer.
8. Visually inspect 100% of the galvanized round, square and rectangular tubes for defects like but not limited to cracks at the tube corners.

I. Weld Inspection and Testing: The District’s Testing Laboratory shall make the following inspections and tests of the welds and welding processes. Welds performed in the fabricating shop may be inspected in the field unless continuous monitoring of the welding process is herein specified or if access in the field due to other work or shop finishes makes field inspection impractical:

1. Approve Welding Procedure Specifications submitted by the Contractor. Approve any changes submitted by the Contractor to any WPS that has already been approved. Obtain the Welding Procedure Qualification Record (WPQR) for each successful WPS qualification.
2. Verify welder qualifications either by certification and/or by retesting. Obtain welder certificates.
3. Verify welding electrodes to be used and other welding consumables as the job progresses.
4. Periodically observe joint preparation, assembly practice, welding techniques including preheating and sequence, and the performance of welders with sufficient frequency to assure compliance with code and contract document requirements.
Check preheating to assure conformance with AWS D1.1, Section 5.6. Verify procedure for control of distortion and shrinkage stresses.

5. Observe joint preparation and fit up, backing strips, and runout plates for welded moment connections and column splices.

6. Periodically provide visual inspection of the root pass of partial and complete joint penetration welds.

7. Visually inspect 100% of welds for proper size, length, location, and weld quality in accordance with AWS D1.1 and D1.8 requirements. Unless specifically noted otherwise, all welding shall be considered statically loaded nontubular connections.

8. Visually inspect 100% of the welds of anchors to embedded plates that are to be cast into concrete elements.

9. In addition to the inspections above, perform the following:
   a. Continuously monitor and observe joint preparation, assembly practice, welding techniques including preheating and sequence, and the performance of welders for 100% of complete joint penetration welds and partial joint penetration welds, Plug and Slot welds, multipass fillet welds, and single-pass fillet welds greater than 5/16 inch. Check preheating to assure conformance with AWS D1.1, Section 5.6. Verify procedure for control of distortion and shrinkage stresses.
   b. Periodically monitor welding of single-pass fillet welds that are less than or equal to 5/16 inch.
   c. Periodically monitor the method of attaching the steel floor and roof decking to the structural frame.
   d. Periodically monitor the welding of headed studs to steel members.

10. Weld Verification Testing Scope:
   a. Perform nondestructive examination services using a qualified technician with the necessary equipment to perform the following:
      (1) Nondestructive examination conducted in accordance with the specific requirements for the item being examined including radiographic (RT), ultrasonic (UT), magnetic particle (MT), or dye-penetrant inspection (PT). Nondestructive inspection procedures shall conform to AWS D1.1 and D1.8.
      (2) Interpret, record, and report results of the nondestructive tests.
      (3) Mark for repair, any area not meeting Specification requirements. Correction of rejected welds shall be made in accordance with AWS D1.1.
      (4) Re-examine repair areas and interpret, record, and report the results of examinations of repair welds.
      (5) Verify that quality of welds meet the requirements of AWS D1.1.
   b. Fillet welds. provide the following:
      (1) MT test a minimum of 10% of the length of each fillet weld exceeding 5/16".
(2) Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.

c. Partial joint penetration welds, including flare-bevel groove welds, provide the following:
(1) MT test a minimum of 25% of the length of each PJP weld exceeding 5/16” effective throat.

(2) Periodic MT testing of representative PJP welds 5/16” and less but need not exceed 10% of all such welds, except as provided in (3) below.

(3) Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.

d. Complete joint penetration welds, provide the following:
(1) All CJP welds exceeding 5/16” thickness shall be 100% UT tested per AWS D1.1 Chapter 6 Part F. The testing laboratory shall review the CJP joints to determine where geometry or accessibility precludes the use of standard scanning patterns per AWS D1.1 Chapter 6 Part F. At these locations the testing laboratory shall develop and submit for approval a written testing procedure in accordance with AWS D1.1 Annex K.

(2) Periodic MT testing of representative CJP welds 5/16” and less not to exceed 10% of all such welds, and 25% of all beam-to-column CJP welds, except as provided in (3) below.

(3) Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.

e. Acceptance Criteria
(1) Visual, MT, PT shall be per AWS D1.1 Table 6.1.

(2) UT testing shall be per AWS D1.1 6.13.1 and Table 6.2.

f. Base metal thicker than 1.5 inches, where subjected to through-thickness weld shrinkage strains, shall be UT tested for discontinuities behind and adjacent to such welds. UT testing shall occur no sooner than 24 hours after the weld has cooled to ambient temperatures. Any material discontinuities shall be recorded on the basis of ASTM A435 or ASTM A898 (Level 1 criteria) and reported for Engineer disposition.

g. Welds of Anchors to Embedded Plates:
(1) Headed Studs: Perform field bend tests according to AWS D1.1 on 2% of the studs welded to plates, but not less than one stud per plate.

(2) Deformed Bar Anchors: Perform MT testing on 10% of deformed bar anchors larger than #5 bar.

h. The costs of repairing defective welds and the costs of retesting by the Testing Laboratory providing services for the District shall be borne by the Contractor. If removal of a backing strip is required by the Testing Laboratory to investigate a suspected weld defect, such cost shall be borne by the Contractor.

J. High-Strength Bolting Inspection and Testing: The District’s Testing Laboratory shall perform the following inspections and test for connections joined with high-strength bolting. Bolting performed in the shop may be inspected in the field unless continuous monitoring of the bolting operation is herein specified:
1. Observe preinstallation verification testing of the pretensioning method to be used in accordance with the requirements of the “Specification for Structural Joints Using ASTM A325 and A490 Bolts”. Daily check the calibration of impact wrenches used in field bolted connections.

2. Inspect bolt installation for 100% of high strength bolted connections according to inspection procedures outlined in the "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

3. Perform Arbitration Testing and Inspection according to procedures outlined in the "Specification for Structural Joints using ASTM A325 or A490 Bolts" when a disagreement exists between the Testing Laboratory and the Fabricator as to the minimum tension of installed bolts that have been inspected according to paragraph above.

4. Monitoring of Bolting Installation:
   a. Continuous Monitoring: The District’s Testing Laboratory shall be continuously present and monitor the bolting installation for compliance with the selected procedure for installation as specified in the “Specification for Structural Joints Using ASTM A325 and A490 Bolts” for joints using high-strength bolts that are designated on the plans as Pretensioned (PT) or Slip-Critical (SC) type joints and that are being installed using the calibrated wrench method or the turn-of-nut without matchmarking method of installation.
   b. Periodic Monitoring: All other joint types and bolt installation methods may be monitored on a periodic basis.

K. Non-shrink grout for base plates and bearing plates:

1. Compressive Strength Tests (by the District’s Testing Laboratory): Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C109 - Modified. Test one set of three cubes at 1 day, and one set of three cubes at 28 days.

2. Frequency of Testing: One set of cubes (6 cubes) shall be made for each day's operation of grouting ducts.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Interior metal studs and furring for support of gypsum board.
2. Suspended framing system for interior suspended ceilings.
3. Backing for interior items to be attached to gypsum board and metal studs.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
1. Section 07 92 00 - Joint Sealants: Provision of acoustical sealant.
2. Section 09 29 00 - Gypsum Board: Provision of gypsum board.
3. Section 09 51 00 - Acoustical Ceilings: Provision of acoustical ceiling systems.
5. Section 10 11 00 - Visual Display Surfaces: Provision of visual display surfaces.
7. Section 10 56 13 - Metal Storage Shelving: Provision of fixed metal shelving units.

1.2 REFERENCES

A. AISI - American Iron and Steel Institute

B. ASTM - American Society for Testing and Materials
3. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. AWS - American Welding Society
1. D1.3 - Structural Welding Code - Sheet Steel

D. CBC - California Building Code, 2016 Edition

E. GA - Gypsum Association
1. 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.
F. ICC - International Code Council
G. SSMA - Steel Stud Manufacturers Association
H. USG - United States Gypsum Company
   1. Drywall/Steel Framed Systems, SA923/rev. 3-02.

1.3 SYSTEM DESCRIPTION

A. Design Requirements
   1. Plumb, true, straight and rigid framing for support of attached materials.
   2. Design system to accommodate construction tolerances, deflection of building structural members, support of attached materials and clearances of intended openings in accordance with CBC.
   3. Gypsum board ceilings shall not support materials or building components other than grilles, light fixtures, small electrical conduits and small ducts. Such components shall be supported by supplemental framing which is supported by main runners. No vertical loads other than gypsum board dead load shall be applied to cross-furring.

1.4 SUBMITTALS

A. Product Data: For each type of metal framing product and accessory indicated, including manufacturer’s typical details, ICC report, specifications and installation instructions.

1.5 QUALITY ASSURANCE

A. Welder Qualifications: Qualified in accordance with AWS D1.3 for welding process, position, type of weld and type of steel.

B. Regulatory Requirements
   1. Comply with fire resistance ratings as indicated and as required by governing authorities and codes.
   2. Provide materials, accessories, and application procedures that have been listed by an approved testing agency or tested according to ASTM E119 for the type of construction shown.

C. Perform work in accordance with GA 203 and ASTM C754, governing laws, building code requirements, manufacturer’s printed recommendations and USG’s “Drywall/Steel Framed Systems, SA923/rev. 3-02.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection
   1. Deliver materials to job site and store in ventilated dry locations. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather.
   2. Handle materials carefully to prevent damage. Remove damaged items and provide new items.
PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Acceptable Manufacturers
   1. Steel Framing and Furring: Member of SSMA (ICC ER-4943P).
   2. Grid Suspension Assemblies: Chicago Metallic Corp.; USG Interiors, Inc.; National Rolling Mills Co., or equal.

2.2 STEEL FRAMING FOR STUDS AND FURRING

A. Studs: C-shaped, ASTM C645, with galvanized coating ASTM A653; G60; non-load bearing rolled steel, channel shaped, punched for utility access.
   1. Depth and Flange Width: As indicated on the Drawings.
   2. Gauge: As indicated on the Drawings.
   3. Tracks: Match stud gauge and depth. 1-1/4 inch flange width unless noted otherwise.
   4. Spacing: 16 inches on center throughout.

B. Deflection Tracks: Manufacturer’s standard top runner designed to prevent cracking of gypsum board applied to interior studs resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A568 or ASTM A653, 16 gauge minimum. Width to accommodate depth of studs and of the following configuration:
   1. Top Runner with Slotted Flanges: 2-1/2 inch deep flanges with slots 1 inch on center.
   2. Product: SlipTrack, Inc. (ICC ESR-2049), or equal.

C. Stiffeners or Bridging: Unpunched channel shape, formed of 16 gauge steel to required dimensions.

D. Furring and Bracing Members: Same material and finish as studs, thickness to suit purpose; bracing members shall be unpunched.

E. Steel Rigid Furring Channels: ASTM C645, hat shaped, depth of 7/8-inch, and minimum thickness of base (uncoated) metal as follows:
   1. Thickness: 0.0179-inch, unless otherwise indicated.

F. Z-Furring Members: Manufacturer’s standard Z-shaped furring members with slotted or nonslotted web, fabricated from steel sheet complying with ASTM A568 or ASTM A653; with a minimum base metal (uncoated) thickness of 0.0179-inch, face flange of 1-1/4 inch, wall-attachment flange of 7/8-inch, and of depth required to fit insulation thickness indicated.

G. Resilient Channels: As manufactured by ClarkDietrich Building Systems, “RC Deluxe (RCSD); no known equal.
   2. Thickness: 22 mil (0.0232-inch design thickness).
H. Hat Channels: Hat-shaped, corrosion-resistant rigid furring channels, ASTM C645, 7/8-inch deep unless otherwise indicated, base metal thickness as required, as manufactured by Dietrich Metal Framing, Inc., “FC-Series”, or equal.

I. Sheet Steel: ASTM A653.

J. Metal Screws: Self-drilling and self-tapping; No. 8 and larger as noted on the Drawings; ITW Buildex, “TEKS (ICC ESR-1976)”, or equal; screws shall penetrate substrate by a minimum of 3 full threads exposed; use low profile heads as required by architectural finish.

K. Powder Driven Fasteners
   1. Tempered steel pins with special corrosive resistant plating or coating.
   2. Pins shall have guide washers to accurately control penetration.
   3. Fastening shall be accomplished by low-velocity, piston-driven, powder accentuated tool.
   4. Pins and tool shall be Hilti, “X-U Fasteners (ICC ESR 1385)”, or equal.

L. Expansion Bolts: Hilti Fastening Systems, “Kwik Bolt TZ Concrete Anchors (ICC ESR-1917)”, or equal.

M. Metal Backing Plates: As indicated on the Drawings.

N. Bracing: Provide cross diagonal straps, attached as indicated on the Drawings and per stud manufacturer’s specifications for frame stability.

O. Welding Electrodes: AWS low hydrogen; rod number and diameter as approved by District’s Testing Agency.

2.3 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

A. General: Provide components of sizes indicated but not less than that required to comply with CBC and ASTM C754 for conditions indicated.

B. Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft temper, with gauge in accordance with CBC.

C. Angle-Type Hangers: Angles with legs not less than 7/8-inch wide, formed from 0.0635-inch thick galvanized steel sheet complying with ASTM A653, G60 Coating Designation, with bolted connections and 5/16-inch diameter bolts.

D. Channels: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch wide flanges, and as follows:
   1. Carrying Channels: 1-1/2 inches deep, 1.12 pound/foot minimum, hot rolled.
   2. Furring Channels: 7/8-inch deep, 26 gauge, galvanized hat sections at 24 inches maximum center to center.
   3. Finish: ASTM A653, G60 hot-dip galvanized coating where indicated.

E. Steel Studs for Furring Channels: ASTM C645, with flange edges bent back 90 degrees and doubled over to form 3/16-inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:
1. Thickness: 0.0179 inch, unless otherwise indicated.
2. Depth: 1-5/8 inch, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Acoustical Sealant: As specified in Section 07 92 00.

B. Galvanized Finish Touch-Up Coating: Liquid zinc compound that bonds electrochemically to iron, steel and aluminum, as manufactured by ZRC Chemical Products, “ZRC Cold Galvanizing Compound”, or equal.

2.5 FINISHES

A. Galvanized Surfaces: Where galvanizing is removed by welding or other assembly procedures, clean area of any foreign matter by wire brushing and metal conditioner recommended by galvanized finish touch-up manufacturer. Apply galvanized touch-up coating by brush or spray with minimum coverage of 1.4 mils, dry film.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive metal support framing systems and verify the following:
   1. Installation of building components located in walls is complete.
   2. Backing plates are properly located for support of wall hung items.

B. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLING STEEL FRAMING FOR STUDS AND FURRING

A. Studs - Typical
   1. Align and secure top and bottom tracks. Place 2 beads of acoustic sealant between tracks and substrate. Tracks shall be securely anchored to supporting structure, with fasteners specified at no more than 32 inches on center.
   2. Fit tracks under and above openings; secure intermediate studs at spacing of wall studs.
   3. Abutting or intersecting pieces or track shall be securely anchored to a common structural element or spliced together. Do not splice studs.
   4. Install studs vertically at spacing as indicated. Place 2 beads of acoustic sealant between studs and adjacent vertical surfaces.
   5. Connect studs to tracks using fastener method.
   6. Construct corners using minimum 3 studs.
   7. Double studs vertically at wall openings, door and window jambs and not more than 2 inches each side of openings, unless otherwise specified. Provide track and stud horizontally at wall, window head and sill openings.
   8. Brace stud framing system and make rigid.
      a. Diagonal bracing shall be installed at locations indicated for frame stability.
      b. Install bridging as indicated on the Drawings.
      c. Wire tying of framing members shall not be permitted.
9. Coordinate erection of studs with requirements of door and window frame supports and attachments.
10. Align stud web openings.
11. Coordinate installation of jamb anchors and metal backing plates with electrical and mechanical work to be placed in or behind stud framing.
12. Welded connections shall be made by resistance spot fusion welding, fillet welding, or plug welding and shall be done in accordance with the latest recommended procedures and practices of AWS.
13. Do not cut or notch stud flanges or cut additional opening in stud web.
15. Provide all angles, clips and other miscellaneous pieces necessary to attach light gauge framing to building structure or to attach other materials to light gauge framing.

B. Backing in Studs or Furring
1. Verify that any pre-drilling of backing and attachment of spacers to prevent crushing of attached material is done prior to application of attached material.
2. Securely weld or screw cut sections of unpunched stud to at least 3 studs or furring supports, leaving flat surface of backing stud web to receive attachment of object to be secured.
3. If it is determined by the Architect that backing was not provided for any items as required, the Contractor shall remove the finish materials; install backing and shall patch and refinish surface to match adjacent area and surface at no additional cost to the District.

C. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8-inch from plane of faces of adjacent framing.

3.3 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

A. Suspend ceiling hangers from building structural members and as follows:
1. Hangers shall be saddle-tied around main runners to develop full strength of hangers.
2. Cross-furring shall be saddle-tied to main runners with 1 strand of No. 16 or 2 strands of No. 18 gauge tie wire.
3. Main runners shall be spliced by lapping and interlocking flanges 12 inches minimum and tying near each end with double loops of No. 16 gauge wire.
4. Cross-furring shall be spliced by lapping and interlocking the pieces 8 inches minimum and tying near each end with double loops of No. 16 gauge wire.
5. Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns. Make all tight turns within a distance of 1-1/2 inches. Hanger or bracing wire anchors to the structure shall be installed in such a manner that the direction of the wire aligns as closely as possible with direction of the forces acting on the wire.
   a. Wire turns made by machine where both strands have been deformed or bent in wrapping can waive the 1-1/2 inch requirement, but the number of turns shall be maintained, and be as tight as possible.
6. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, and conduit.
7. Provide trapeze or other supplementary support members at obstructions to main hanger spacing.
8. Provide additional hangers, struts or braces as required at all ceiling breaks or discontinuous areas.
9. Hanger wires that are more than 1 in 6 out of plumb shall have counter-sloping wires.

B. Light Fixture Support
1. Recessed or drop-in light fixtures shall be supported directly by main runners or by supplemental framing which is supported by main runners.
2. Surface mounted fixtures shall be attached to main runner by positive clamping device made of material with a minimum of 14 gauge. Rotational spring catches do not comply.
3. Light fixtures, HVAC diffusers, speakers, etc., shall have minimum 2 wires at opposite ends for support if ceiling should fail during seismic fault.

C. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8-inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.

3.4 FIELD QUALITY CONTROL

A. The District’s Testing Agency will provide periodic inspection of welding, including prior fit-up welding equipment, weld quality, and welder certification in accordance with AWS and CBC.

END OF SECTION
PART 1 - GENERAL

1.1  SUMMARY

A.  Section Includes
1.  Painted steel guardrail as indicated on the Drawings.
2.  Painted steel trash enclosure roof as indicated on the Drawings.
3.  Metal gates as indicated on the Drawings.
4.  Steel ceiling access ladder.
5.  Countertop supports.
6.  Partition post at cantilever wall at LLRC service desk.
7.  Non-structural miscellaneous metal channels, angle imbeds, backing and mounting plates, and other shapes as required.
8.  Rough hardware.

B.  Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C.  Related Sections
1.  Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of sheet metal flashing and trim.
2.  Section 09 90 00 - Painting and Coating: For finish painting of items not specified to have factory finish.

1.2  REFERENCES

A.  ADA - Americans with Disabilities Act

B.  AGA - American Galvanizers Association
1.  Inspection Manual for Hot Dip Galvanized Products.

C.  AISC - American Institute of Steel Construction Inc.

D.  ANSI - American National Standards Institute
1.  A14.3 - Safety Requirements for Fixed Ladders.
2.  B18.2.1 - Square and Hex Bolts and Screws - Inch Series.
5.  B18.6.4 - Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch).
E. ASTM - American Society for Testing and Materials
  10. A384 - Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
  12. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  16. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
F. AWS - American Welding Society
   1. D1.1 - Structural Welding Code - Steel.
   2. D1.3 - Structural Welding Code - Sheet Steel.
   3. D1.6 - Structural Welding Code - Stainless Steel.

G. CBC - California Building Code, 2016 Edition

H. NAAMM - National Association of Architectural Metal Manufacturers
   1. MFM - Metal Finishes Manual for Architectural and Metal Products.

I. SSPC - The Society for Protective Coatings
   1. PA 1 - Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.
   2. SP 2 - Surface Preparation Specification No. 2: Hand Tool Cleaning.
   3. SP 3 - Surface Preparation Specification No. 3: Power Tool Cleaning.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements
   1. Wind Load Requirements for Exterior Items: Members shall withstand dead and live loads caused by pressure and suction of wind in accordance with CBC.
   2. Work shall support normally imposed loads in conformity with AISC requirements.
   3. Provide for expansion and contraction.
   4. Exterior items shall exclude water.
   5. Structural Performance of Guardrails, Handrails, and Railings: Provide guardrails, handrails, and railing systems that shall withstand structural loads without exceeding the allowable working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each of the
   6. Ladder to Ceiling Access: Design ladder in accordance with requirements of NAAMM, except that for vertical ladder, the distance from ladder rung to wall shall not be less than 7 inches.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for paint products and grout.

B. Shop Drawings: Submit shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
   1. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
   2. Where welded connections and concrete inserts are required, show size and locations required.

C. Quality Control Submittals: Welder certificates signed by Contractor certifying that welders comply with requirements specified under the “Quality Assurance” Article.

D. Samples: Only as requested by the Architect.
1.5 QUALITY ASSURANCE

A. Welding Standards: Comply with applicable provisions of AWS D1.1 and AWS D1.3.
   1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Design Criteria
   1. Work shall be designed to support normally imposed loads and conform to AISC requirements.
   2. Built-up parts shall not exhibit warp.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.

B. Discharge materials carefully and store on clean concrete surface or raised platform in safe, dry area.

1.7 JOB CONDITIONS

A. Scheduling and Sequencing
   1. Ensure timely fabrication of items to be embedded or enclosed by other work.
   2. Furnish information and assistance required for locating embedded items and be responsible for proper locations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Steel and Iron
   1. Steel Plates, Shapes, and Bars: ASTM A36.
   2. Rolled Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.
   3. Cold-Formed Steel Tubing: ASTM A500.
      a. For exterior installations and, where indicated, provide metalized-tubing.
   5. Steel Pipe: ASTM A53, Type S, Grade B, Schedule 40, unless otherwise indicated, or another weight required by structural loads.
      a. Black finish, unless otherwise indicated.
      b. Prime with red oxide primer at locations detailed to receive paint.
   6. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 316L.
   7. Stainless Steel Tubing: ASTM A554, Grade MT 316L.

10. Concrete Inserts: Anchors of type indicated below, fabricated from corrosion resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
   a. Threaded or wedge type; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized in accordance with ASTM A153.
   b. Provide weld plate imbedded in concrete as detailed in the Drawings. Coordinate location with other imbedded materials.

C. Fasteners: Provide plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls, concrete slabs, or ceilings. Select fasteners for the type, grade, and class required.
   1. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A, with hex nuts, ASTM A563, and, where indicated, flat washers.
   8. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in concrete and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
      b. Material: Group 1 alloy 304 or 316 stainless steel bolts and nuts complying with ASTM F593 and ASTM F594.


D. Welding Materials: AWS D1.1 and AWS D1.3, type required for materials being welded.
   1. Electrodes: E = 70XX.

2.2 STANDARD CATALOG PRODUCTS

A. Non-Shrink Grout
   1. Premixed; containing no metallic particles, requiring only addition of water.
   2. Shall have minimum working time of 15 minutes and initial set time of 30 to 45 minutes in accordance with ASTM C191.
B. Expansion Cement
   1. Non-metallic, non-corrosive, pourable hydraulic type cement that is quick-setting, high strength, and non-shrinking, with the following properties
      a. Compressive Strength: 58,400 psi at 7 days in accordance with ASTM C109.
      b. Volume Change: Plus 0.31 at 7 days in accordance with ASTM C157.

C. Coatings
   1. Coatings for Protection of Dissimilar Materials
      a. Dissimilar Metals: Bituminous type materials in accordance with ASTM D1187.
      b. Aluminum in Contact with Concrete, Metal, Wood, or other Absorptive Material.
   2. Shop Primer for Ferrous Metal: VOC compliant, fast-curing, lead and chromate free, universal modified alkyd primer with good resistance to corrosion, compatible with finish paint systems.
   4. Galvanizing Repair Paint: High zinc dust content paint, with dry film containing not less than 94 percent zinc dust by weight, as manufactured by Parker Amchem, “Galvaprep SG”; Sherwin Williams, “Zinc Clad I”; Rust-Oleum, or equal.
   5. Exterior metal components/fabrications that are intended to be exposed at the completion of construction and their attachments shall be shop treated with galvanic “metalized” process; then shop primed, and painted as indicated herewith.

D. Partition Post at Cantilever Wall at LLRC Service Desk: 1-1/2 inch round stainless steel post with full length channels for 1/4-inch thick glass; flat cap and welded base plate; brushed stainless steel finish.
   1. Configuration: Provide end, center posts as required and as indicated on the Drawings.
   2. Height: 24 inches.

E. Handrail Brackets: As indicated in details and as selected by the Architect.

2.3 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on Construction Drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Preparation
   1. Coordinate with other work supporting or adjoining miscellaneous metal and verify requirements of cutting out, fitting, and attaching.
   2. Verify sizes, designs, and locations of items; do so at site whenever construction progress permits.
C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

D. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the fabrication and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
   1. Temperature Change (Range): 100 degrees Fahrenheit.

E. Shear and punch metals cleanly and accurately. Remove burrs.

F. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

G. Remove sharp or rough areas on exposed traffic surfaces.

H. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Use electric shielded-arc process in accordance with AWS.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
   5. Miter corners and angles of frames unless otherwise indicated.
   6. Make welds normally exposed to view in finished work uniform and grind smooth.

I. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

J. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

K. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

L. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

M. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
N. Bolted and Screwed Connections
   1. Use bolts for field connections only, and then only as noted. Countersink heads; finish smooth and flush.
      a. Provide washers under heads and nuts bearing on wood.
      b. Draw nuts tight and prevent loosening of permanent connections by nicking threads.
      c. Use beveled washers where bearing is on sloped surfaces.
   2. Where necessary to use screws for permanent connections in ferrous metal, use flat head type, countersink, fill screw slots, and finish smooth and flush.
   3. Evenly space exposed heads.

2.4 GUARDRAILS, HANDRAILS, AND RAILINGS

A. General: Fabricate guardrails, handrails, and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube or pipe, post spacings, and anchorage, but not less than that required to support structural loads.

B. Interconnect handrail and railing members by butt-welding or welding with internal connectors, at fabricator’s option, unless otherwise indicated.
   1. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to which end is joined, and weld all around.

C. Form changes in direction of handrails and railings as detailed.

D. Form simple and compound curves by bending tube or pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of tube or pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

F. Close exposed ends of tube or pipe by welding 3/16-inch thick steel plate in place or with prefabricated fittings.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, post base flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of handrails and railing systems to other work. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work.

H. Fillers: Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

I. For galvanized handrails and railing systems, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
J. For non-galvanized steel handrails and railing systems, provide non-galvanized ferrous metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in masonry and concrete construction.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Equip units with integrally welded anchors for casting into concrete. Furnish inserts if units must be installed after concrete is placed.
      a. Except as otherwise indicated, space anchors 24 inches on center and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4-inch thick by 8 inches long.

C. Galvanize miscellaneous interior and exterior framing and supports.

2.6 STEEL LADDER

A. General: Fabricate ladder for location shown, with dimensions, spacings, details, and anchorages as indicated.
   1. Comply with ANSI A14.3, unless otherwise indicated.
   2. Extend side rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided.
   3. Siderails: Continuous, 1/2-inch by 2-1/2 inch steel flat bars, with eased edges, spaced 18 inches apart.

B. Bar Rungs: 3/4-inch diameter steel bars, spaced 12 inches on center.
   1. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

C. Support ladder at top and bottom and not more than 60 inches on center with welded or bolted steel brackets. Brace ladder at floor. Size brackets to support design loads specified in ANSI A14.3.

D. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

E. Galvanize steel ladders, including brackets and fasteners.

2.7 STEEL FINISHES, GENERAL

A. Comply with NAAMM’s MFM for recommendations relative to applying finishes. Finish metal fabrications after assembly.
2.8 STEEL AND IRON FINISHES

A. Exterior metal components/fabrications that are intended to be exposed at the completion of construction and their attachments shall be shop treated with galvanic “metalized” process; then shop primed and painted as indicated herewith.

B. Galvanizing
   1. Galvanize items after fabrication in largest sections practicable unless otherwise permitted or recommended by ASTM A384 and ASTM A385.
   2. Where galvanizing is removed by welding or other assembly procedures, touch up abraded areas with molten zinc or zinc-rich paint.
   3. Where ferrous metal item is noted to be galvanized, perform galvanizing in accordance with following standards as applicable to item:
      b. Other Fabricated Items: ASTM A123.

C. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Typical: SSPC SP 2, SSPC SP 3, as required.

D. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, unless otherwise indicated. Comply with requirements of SSPC PA 1 for shop painting.

E. Stainless Steel
   1. Remove or blend tool and die marks and stretch lines into finish.
   2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
   3. Satin, Directional Polish: No. 6 finish.
   4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

F. Finish Painting: As specified in Section 09 90 00.

2.9 SOURCE QUALITY CONTROL

A. Test and Inspections: The District will employ testing laboratory to test welds per CBC, Section 1705A.2.2.5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete inserts, through-bolts, lag bolts, wood screws, and other connectors as required. Fasteners not installed but required after pour shall be submitted to the Architect for approval. Fastener shall not be installed until the Architect approval is received.
B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been galvanized after fabrication and are intended for bolted or screwed field connections.

E. Field Welding
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING GUARDRAILS, HANDRAILS, AND RAILINGS

A. Adjust guardrails, handrails, and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows
   1. Anchor posts to post tension concrete by welding directly to imbedded steel supporting members.
   2. Anchor handrail and post ends to cast-in-place concrete and masonry with steel flanges welded to rail ends and anchored into wall construction with drilled-in epoxy and bolt anchors.

B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with 1-1/2 inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows
   1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
   2. For wood stud partitions or walls, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
   3. For steel framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.
C. Standard Catalog Products: Install standard catalog products in accordance with manufacturer’s installation instructions and reviewed shop drawings.

3.3 SETTING

A. Set item shown or required to be installed in sleeves with quick-setting anchor cement unless otherwise noted.

B. Use non-shrink grout mixed in accordance with manufacturer’s directions for setting plates, bolts, and similar items.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and prime and paint exposed areas with same material as used for shop painting to comply with SSPC PA 1 requirements for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a 2.0-mil minimum dry film thickness.

B. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related Sections
   1. Section 05 12 00 – Structural Steel
   2. Section 06 18 00 – Glued Laminated Units
   3. Section 06 19 50 – Prefabricated Wood I-Joists

1.2 DESCRIPTION OF WORK

A. Definition: Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated. Types of work in this section include rough carpentry for:
   1. Wood framing.
   2. Timbers for posts and beams.
   3. Wood nailers, blocking and sleepers.
   5. Roof, floor and wall sheathing.
   6. Fasteners
   7. Rough hardware

1.3 QUALITY ASSURANCE

A. Codes and Standards
   1. California Code of Regulations, Title 24, 2016 edition, also known as California Building Code (CBC), with Division of the State Architect (DSA) amendments.
   2. Lumber Standards: Lumber of the specified species furnished under this section shall be inspected and comply with the grading rules of the appropriate following associations. Factory-mark each piece of lumber with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.
a. WCLIB West Coast Lumber Inspection Bureau, “Standard Grading Rules No. 16”.
b. WWPA Western Wood Products Association, “Grading Rules for Lumber”.

3. Plywood Product Standards: Comply with PS 1 (ANSI A 199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard for type of panel indicated.

a. Plywood shall bear APA grade trademark.

4. AWPA P5-15, “American Wood Preservers Association Standards”.


B. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

C. Qualifications

1. Framing Contractor: The Framing Contractor shall have not less than 10 years experience in the successful framing of wood structures regulated by DSA similar to this project.

1.4 PREINSTALLATION CONFERENCE

A. At least 14 days prior to beginning wood framing, the Contractor shall hold a meeting to review the detailed quality control and construction requirements and to determine the procedures for producing proper wood frame construction. Contractor shall also review the requirements for submittals, status of coordinating other trades, and availability of materials. Contractor shall establish work progress schedule and procedures for materials inspection, testing and certifications.

B. The Contractor shall require responsible representatives of every party who is concerned with the wood frame work to participate in the conference, including but not limited to the following:

1. Contractor’s Superintendent
2. Framing Superintendent
3. Special Inspector (IOR)
4. Laboratory representative responsible for inspections and testing
5. District’s representative
6. Architect/Engineer’s representative(s)
7. Framing Hardware and I-Joist manufacturer’s representatives

C. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed to all parties concerned within five days of the meeting. Minutes shall be transmitted to all meeting attendees and the Architect, Structural Engineer, and District.
1.5 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for materials listed below:

1. Shop drawings of specially fabricated rough hardware.

B. Samples: Submit to the Architect samples of architecturally exposed decking and lumber, 24" long x full width x full depth, showing the range of variation to be expected in appearance.

C. Wood Treatment Data: Submit treatment manufacturer's instructions for proper use of each type of treated material.

1. Pressure Treatment: For each type specified, include certification by treating plant stating chemicals and process used, net amount of preservative retained and conformance with applicable standards.

2. Water-Borne Preservatives: Include statement that moisture content of treated materials was reduced to a maximum of 15% prior to shipment to project site.

1.6 PRODUCT HANDLING

A. Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks.

1.7 JOB CONDITIONS

A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber, General:

1. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

   a. Provide dressed lumber, S4S, unless otherwise indicated.

   b. Provide seasoned lumber with 19% maximum moisture content at time of dressing.

   c. Provide unseasoned lumber with moisture content in excess of 19% allowed at time of dressing.

B. Framing Lumber: Provide lumber in the following grades unless otherwise noted on the structural drawings.

2. 2x and 3x Studs – Douglas Fir No. 2, S-Dry
3. Plates - Douglas Fir No. 2, S-Dry
4. 4x and 6x Posts - Douglas Fir No. 1, Green
5. 2x and 3x Joists - Douglas Fir No. 1, S-dry
6. 4x and 6x Beams and Headers – Douglas Fir No. 1, Green
7. Blocking and miscellaneous framing – Douglas Fir No. 2, S-Dry
   a. E=1,600,000 psi; Fb = 2,400 psi; Fv = 400 psi; Ft = 1,700 psi; Fc = 2,450 psi.

C. Plywood:
   1. Trademark: Identify each plywood panel with appropriate American Plywood Association (APA) trademark.
   2. Provide Plywood in grade, thickness and panel rating as specified on the structural drawings. Plywood 15/32” and thicker shall be 5 ply.

D. Fasteners
   1. Nails: Common wire, typical; hot-dipped galvanized at exposed conditions and pressure-treated lumber
   2. Bolts and sill bolts in wood shall be ASTM A307 hex head with standard cut threads; full body diameter bolts (no rolled or “upset” threads permitted) per ANSI/ASME standard B18.2.1.
      a. Provide standard cut washers and hex nuts unless otherwise noted.
      b. Plate washers: ASTM A36
      c. Provide dome head carriage bolts where specified.
   3. Lag Screws shall be in accordance with ANSI/ASME Standard B18.2.1.
   4. Provide hot-dipped galvanized fasteners at the following conditions:
      a. Exposed exterior conditions
      b. Connections in pressure treated and fire treated lumber and plywood.
      c. Wherever specified on the drawings.

E. Metal Framing Hardware
   1. Fabricate from sheet steel with the following finishes:
      a. Connectors not exposed to weather or in contact with pressure treated lumber shall have standard G90 zinc coating.
      b. Connectors in contact with pressure treated lumber shall have G185 hot dipped galvanized coating per ASTM A653.
c. Connectors in exterior applications (non-marine environments) shall have G185 hot dipped galvanized coating per ASTM A653.

2. Nails and nailing shall conform to the manufacturer’s instructions, with a nail provided for each punched nail hole. Use maximum nail size listed by manufacturer.
   a. Nails into pressure treated lumber shall be hot dipped galvanized.
   b. Fasteners with G185 Galvanized connectors shall be hot dipped galvanized fasteners.
   c. Fasteners with Stainless Steel connectors shall be stainless steel fasteners.

3. Framing hardware shall be by Simpson Company or equal product substituted per Division 1 requirements for Substitutions.

2.2 WOOD TREATMENT

A. Preservative Treatment: Where lumber is indicated as "PT" or "Treated," or is specified herein to be treated, comply with applicable requirements of American Wood Preservers Association (AWPA) Standards C2 (Lumber) and of American Wood Preservers Bureau (AWPB) Standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.

   1. Pressure-treat above-ground items with water-borne preservatives complying with AWPB LP-2. After treatment, kiln-dry to a maximum moisture content of 15%. Treat indicated items and the following:
      a. Wood cants, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
      b. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.

   2. Complete all fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

B. Fire-Retardant Treatment: Where "FR-S" lumber or plywood is specified or otherwise indicated provide materials which comply with AWPA standards for pressure impregnation with fire-retardant chemicals, and which have a flame spread rating of not more than 25 when tested in accordance with UL Subject 723 or ASTM E 84, and show no increase in flame spread and significant progressive combustion upon continuation of test for additional 20 minutes.

   1. Revise above if higher rating is allowable or additional 20 minute testing not required or ratings for smoke developed and fuel contributed also required.

   2. Where treated items are exposed to exterior or to high humidities or are to have a transparent finish in form of stain or sealer, provide materials which show no change in fire-hazard classification when subjected to standard rain test (UL Subject 790 or ASTM D 2898).

   3. Retain above for transparent finished material even if not exposed on exterior.
4. Use fire-retardant treatment which will not bleed through or adversely affect type of finish indicated and which does not require brush treatment of field-made end cuts to maintain fire-hazard classification.

5. Retain below as well as above for lumber with transparent finish.

6. Where transparent finish is indicated use type of treatment and species which permits milling of lumber after treatment without altering indicated fire-hazard classification, as determined by fire testing.

7. Kiln-dry treated items to maximum moisture content of 19%.

8. Provide UL label on each piece of fire-retardant lumber or plywood.

C. Inspection: Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

2.3 SOURCE QUALITY CONTROL

A. Lumber shall be inspected prior to installation for compliance with the grading rules of the appropriate lumber grading associations. Each piece of lumber shall bear factory-mark with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

B. Plywood shall be inspected prior to installation:

1. For evidence of water damage. All plywood sheets exhibiting water damage shall be removed from the site.

2. Every plywood sheet shall bear APA grade trademark and rating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

3. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

4. Use common wire nails, except as otherwise indicated. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members.
5. Nail joints in accordance with CBC Table 2304.10.1 unless otherwise noted. Predrill where nails tend to split the wood. Nails into pressure treated lumber shall be hot dipped galvanized.

6. Bolt holes shall be 1/16 inch oversize. Use standard round cut washers against the wood except as noted otherwise.

7. Lag screws – the clearance hole for the shank shall match the diameter and have the same depth as the length of screw shank. The lead hole for the threaded portion shall have a diameter equal to 60% to 75% of the shank diameter and a length equal to at least the length of the threaded portion. Provide a standard cut washer under the head of the lag screw.

B. Wood Nailers, Blocking and Sleepers:

1. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise show. Where possible, anchor to formwork before concrete placement.

C. Wood Framing, General

1. Provide framing members of sizes and on spacings shown, and frame openings as shown. Do not splice structural members between supports.

2. Firestop concealed spaces with wood blocking not less than 2" thick, if not blocked by other framing members.

3. Provide blocking and backing as shown and as required for the fastening of the work of other trades.

D. Stud Framing:

1. General: Provide stud framing where shown. Install studs true to line and plumb. Unless otherwise shown, use 2" x 6" wood studs spaced 16" o.c. Provide single bottom plate and double-top plates 2" thick by width of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction.

Construct corners and intersections with not less than 3 studs. Provide miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items and trim.

2. Frame openings with multiple studs and headers as detailed on the drawings.

3. Prior to start of framing, inspect all anchor bolts and holdown bolts to verify proper installation.
E. Joist and Beam Framing:

1. General: Provide framing of sizes and spacings shown. Install with crown edge up. Notches and holes shall only be permitted as shown on the structural drawings.

2. Shape joist ends as required to obtain level bearing in hangers and on all wood bearing surfaces.

F. Sill Plates

1. Shear Walls: provide ¼ x 3 1/2 x 3 1/2 plate washers under the nut of sill bolts in shear walls.

2. All other stud walls: provide standard cut washers under the nut of sill bolts.

G. Installation of Plywood:


2. Provide blocking at plywood panel edges where specified on the structural drawings.

3. Maintain 1/8 inch gap between all plywood edges.

4. Plywood sheets shall have a minimum width of 2'-0".

5. Nail heads shall be driven flush with plywood surface. Overdriven nails which fracture the outer ply layer, shall be replaced one-for-one.

6. Floor plywood shall be field glued with an adhesive meeting APA specification AFG-01. Apply adhesive in accordance with the manufacturer’s recommendations. Apply a continuous line of adhesive at all bearing surfaces (joists, beams, blocking, etc.) and in the groove of tongue and groove panels.

7. Two Sided Plywood Shear Walls – where plywood is applied on both faces of stud walls, machine applied nailing may be used on the first face of plywood installation. The second face of plywood nailing shall be performed using hand-applied nailing only.

3.2 QUALITY ASSURANCE INSPECTION DURING CONSTRUCTION

A. The Project Inspector (IOR) shall:

1. Inspect erected wood framing as required to establish conformity of work with the contract documents.

2. Inspect all bolted and screwed connections.

3. Inspect the installation of all timber connectors per CBC Section 1705A.5.
4. Inspect roof and floor plywood diaphragm nailing for nail size, spacing and penetration at panel edges, and for special nailing at collector and drag members where specified on the structural drawings.

5. Inspect shear wall plywood nailing for nail size, spacing and penetration at panel edges, including nailing at holdown posts.

B. Machine Nailing: the use of machine nailing is subject to a satisfactory jobsite demonstration and the approval of the Project Inspector, the Structural Engineer and DSA. The approval is subject to continued satisfactory performance as inspected by the Project Inspector. If nail heads penetrate the outer ply more than would be normal for a hand-held hammer, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory and machine nailing shall be discontinued.

END OF SECTION
SECTION 06 18 00
STRUCTURAL GLUED LAMINATED UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related Sections

1. Section 06 10 00 – Rough Carpentry
2. Section 06 19 50 – Prefabricated Wood I-Joists

1.2 DEFINITION OF WORK

A. Glued laminated timber is defined to include wood members fabricated from 1" or 2" nominal thickness lumber glued face-to-face to a depth of four or more laminations.

B. The types of structural glued laminated units specified in this section include:

1. Straight beams; including girders and purlins, and cambered members.
2. Columns; including posts and standards.

1.3 DESCRIPTION OF WORK

A. Extent of structural glued laminated units (Glulam) is shown on drawings.

B. Provide all labor and material, including connectors, anchors, and accessories with necessary equipment to interconnect and secure Glulam members to building structure for a complete installation.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with all provisions of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1. California Code of Regulations, Title 24, 2016 edition, also known as California Building Code (CBC), with Division of the State Architect (DSA) amendments.

2. American Institute of Timber Construction (AITC) Standards

   a. AITC A190.1 "Structural Glued Laminated Timber"
   b. AITC 110 - Standard Appearance Grades for Structural Glued Laminated Timber
   c. AITC 115 - Standard for Fabricated Structural Timber
d. AITC 117 – Standard for Manufacturing of Structural Glued Laminated Timber

B. Manufacturer Qualification: Provide factory-glued structural units, produced by an AITC-licensed firm, qualified to apply the AITC "Quality Inspected" mark.

C. Factory mark each piece of glued laminated structural units with American Institute of Timber Construction (AITC) Quality Inspected mark. Place AITC mark on surfaces which will not be exposed in the completed work.

D. Installer: Firm which has demonstrated competence specializing in installation of glued laminated timber.

E. All glued laminated members shall be continuously inspected by a qualified special inspector approved by DSA during fabrication for conformance with AITC 115, and CBC Section 1705A.5.4. The special inspector shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected member shall be stamped by the special inspector with an identification mark. Special inspector shall verify and report on pertinent data including:

1. Species, grade and slope of grain of lumber meets specification.

2. Glue is of quality specified; glue bond is over entire surface, and specified pressure and temperature has been met.

3. Moisture content meets specifications.

Exception: Special Inspection is not required for non-custom members of 5 1/8” maximum width and 18 inch maximum depth, and with a maximum clear span of 32'-0", manufactured and marked in accordance with ANSI/AITC 190.1 Section 6.1.1 for noncustom members.

F. Non-custom glued laminated members which do not exceed the width and depth limits in paragraph (E) above are exempt from fabrication inspection provided that they are manufactured and marked in accordance with ANSI/AITC A190.1, Section 6.1.1.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's data, specifications and installation instructions covering lumber, adhesives, fabrication process, accessories and protection.

1. Submit certification indicating glued laminated timbers comply with requirements of ANSI/AITC A190.1.

B. Samples: Submit samples, 48" long x full width x depth of 4 laminations, showing range of variation expected in appearance of architectural grade glued laminated units, including specified treatment, if any. Samples with other requirements are exclusive responsibility of Contractor.

1. Apply specified finish to 3 sides of half-length of each sample.
C. Shop Drawings: Submit shop drawing showing full dimensions of each member and layout of entire structural system. Show large scale details of connections, connectors and other accessories. Indicate species and laminating combination, adhesive type, and other variables in required work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Keep glued laminated structural units dry during delivery, storage, handling, and erection, by maintaining factory-applied protective covering in weather-tight and light-proof condition, or by applying other weathertight protection. Maintain protective covering until building enclosure is completed to extent necessary for protection of interior Glulam work, and until final finishing of exterior work is ready to proceed. Do not store Glulam units in areas of either excessively high or excessively low relative humidity; comply with manufacturer's instructions and provisions of AITC 111 - "Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection."

B. Time the delivery and installation of Glulams to avoid extended on-site storage, and to avoid delaying other trades whose work must follow erection of Glulams.

1. If laminated units are to be stored before erection, place individual units or bundle wrapped units on blocks well off ground with individual members separated for air circulation. Leave wrappings intact, but slit or puncture lower side to permit drainage of water which may accumulate.

PART 2 - PRODUCTS

2.1 STRUCTURAL GLUED LAMINATED UNITS

A. Lumber: Comply with ANSI/AITC A190.1 and applicable lumber association standards cited therein for grades required to achieve Glulam requirements for design values, appearance, fabrication limitations and species (if any).

1. Stress Values for Beams and Truss Chords: Provide glued laminated timber members sized as shown on the drawings with laminating combination 24F-V4 for simple beams and 24F-V8 for cantilevered beams.

2. Stress Values for Axially Loaded Members (Columns and Truss Webs): Provide glued laminated timber members sized as shown on the drawings with laminating combination A-3 (for 4 or more laminations) or other that meets or exceeds the following stress values for normal loading duration and dry condition of use:

   a. Tension parallel to grain (Ft), 1450 psi.
   b. Compression parallel to grain (Fc), 2300 psi.
   c. Modulus of Elasticity (E), 1,800,000 psi.


B. Adhesive: ASTM D 2559 "wet-use" adhesive, unless otherwise indicated.
C. Sealers:

1. End Sealer: Manufacturer's standard transparent, colorless wood sealer, effective in retarding transmission of moisture at cross-grain cuts.

2. Penetrating Sealer: Manufacturer's standard translucent penetrating wood sealer, which will not interfere with application of wood stain and transparent finish, or paint finish, as indicated.
   a. Refer to Division-9 sections for required field-applied finishes.

D. Fasteners, Rough Hardware and Accessories: see 06 10 00 Rough Carpentry.

1. Finish: Except as otherwise indicated, finish fabricated steel assemblies with rust-inhibitive primer, 2.0 mils dry film thickness.

2. Wet-Use Finish: Where "Wet-Use" Glulam work is indicated, finish fabricated steel assemblies with hot-dip zinc coating (ASTM A 153), including bolts and other fasteners.

2.2 FABRICATION

A. General: Comply with ANSI/AITC A190.1 and AITC 117 - "MANUFACTURING" in providing units indicated; where dimensions are not completely documented, provide manufacturer's standard sizes and shapes required to fulfill indicated performances.

1. Shop-cut for connections and connecting hardware to greatest extent feasible, including drilling of bolt holes.

2. Appearance Grade: Provide Industrial Grade Units typical; Architectural Grade units at architecturally exposed conditions.

3. Camber: The required camber for fabrication of each member is shown on drawings, and may be either circular or parabolic, at manufacturer's option.

B. End-Cut Sealing: Immediately after end-cutting each member to final length, and after wood treatment (if any), apply a saturation cost of end sealer to ends and other cross-cut surfaces, keeping surfaces "flood-coated" for not less than 10 minutes.

1. Seal Coat: After fabrication and sanding of each unit, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit, except for treated wood where treatment has included a water repellent.

2.3 FACTORY FINISHING

A. Wiped Stain Finish: Manufacturer's standard "dry-appearance" penetrating acrylic stain-and sealer, oven dried and resistant to mildew and fungus.

1. Provide color selected by Architect from manufacturer's standard colors.

2.4 FACTORY APPLIED PROTECTION

A. Before shipping or exposing to outdoor conditions, individually wrap each member with manufacturer's standard, opaque, durable water-resistant, plastic-coated paper covering with water-resistant seams.

B. At manufacturer's option, small members of uniform size may be bundle-wrapped, in lieu of individual wrappings. Provide protective slip-sheets between finish surfaces where factory-finishes have been provided.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install miscellaneous steel connectors, anchors, and accessories as indicated.

1. Erection shall be in accordance with the best practices, with adequate personnel and equipment and under experienced, qualified supervision. Unless otherwise specified, erection shall conform to standards established by the American Institute of Timber Construction (AITC 105, AITC 106, AITC 111).

2. Plan and execute erection procedures so that close fit and neat appearance of joints and structure as a whole will not be impaired. When hoisting members into place, use padded or non-marring slings; and protect corners with wood blocking.

3. Adequately brace members as they are placed to maintain safe position until full stability is provided.

B. Framing and Bracing:

1. All glued-laminated timber work shall be erected true and plumb, temporary bracing shall be used wherever necessary and shall be adequate for all vertical and lateral loads to which the structure may be subjected, including wind and erection equipment and operation of same. Leave temporary bracing in place as long as may be required for safety, and until final framing construction is completed.

2. Wherever piles of materials, erection equipment or other loads are carried by the timber during its erection and until it is braced by final construction, proper provision shall be made to take care of the stresses resulting from such construction loads.

3. No final connections shall be made until the structure has been properly aligned.

4. Notify the Architect at least 48 hours (2 working days) in advance of all erection.

C. Temporary Construction Platforms: All temporary flooring, planking and scaffolding necessary in connection with the erection of the timber framing or the support of erection machinery shall be provided as part of the erection work. The temporary floors and scaffolding shall conform to the requirements of municipal and/or state laws and governing safety regulations.
D. Fabrication Errors: The cutting or drilling of timber members in the field for the correction of fabrication errors will not be permitted without prior written approval from the Structural Engineer.

E. Cutting: Avoid cutting Glulam members during erection, to greatest extent possible. Except for fastener drilling and other minor cutting, coat cuts with end sealer as specified for "Fabrication".

1. Where treated members must be cut during erection, apply a heavy brush coat of the same treatment, complying with AWPA Standard M4.

F. Handle and temporarily support members to prevent visible surface damage.

G. Do not remove wrapping on individually wrapped members until it will serve no useful purpose, including protection from weather, soiling and damage from work of other trades.

1. Coordinate removal of wrapping with finishing work specified in the Division-9 sections. Retain wrapping wherever it can serve as a painting shield.

H. Repair damaged surfaces and finishes after completion of erection and removal of wrappings, or replace damaged members as directed where damage is beyond acceptable repair.

3.2 FIELD INSPECTION DURING CONSTRUCTION

A. The District’s Project Inspector shall:

1. Inspect erected glulam framing as required to establish conformity of work with the structural drawings.

2. Inspect all bolted connections.

B. Architect shall inspect exposed glulam beams for appearance quality and be the final arbiter on acceptability.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related Sections

1. Section 06 10 00 – Rough Carpentry

2. Section 06 18 00 – Glued Laminated Units

1.2 DESCRIPTION OF WORK

A. Fabrication and installation of all prefabricated wood I-joists, blocking and accessories as shown on the drawings and herein specified.

B. Provide all labor and material, including connectors, anchors, and accessories with necessary equipment to interconnect and secure I-Joists for a complete installation.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with all provisions of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1. California Code of Regulations, Title 24, 2016 edition, also known as California Building Code (CBC), with Division of the State Architect (DSA) amendments.


B. Manufacturer Qualification: I-Joists shall be manufactured by Weyerhauser/Redbuilt LLC (ICC ESR Report #2994), or equal manufacturer substituted per Division 1 requirements. Substitutions are subject to review by the Structural Engineer and DSA. Manufacturer shall have a minimum of 5 years’ experience and possess a current ICC ESR evaluation report. Fabricating plant shall be approved by an independent ICC certified testing agency as prescribed in DSA IR A-5.

I-joists have been designed using the dimensions, allowable values and section properties documented on the structural drawings.

C. Inspection:
1. Continuous independent inspection of Wood I-Joist fabrication is not required.

2. I-Joist manufacturer's quality assurance program shall meet the following requirements:
   a. ASTM D5055 Section 8, 9 and 10.
   b. ICC-ES AC14, Appendix A, “Quality Assurance Guidelines for Prefabricated Wood I-Joists, or ICC-ES approved equivalent such as APA QA Policy for Performance Rated I-Joists.
   c. ICC-ES AC14, Appendix B.
   d. Unannounced audits by a third party auditor of a qualified inspection agency shall be performed per ICC-ES AC14. All quality control reports resulting from such audits must be maintained by the manufacturers and made available to DSA upon request.

1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings of all materials to be furnished under this section. Shop drawings shall include:
   1. Plan layout of members and bridging, including erection bracing and installation instructions.
   2. Details of member connections, stiffeners, blocking and web openings.

B. Certification of I-Joist fabrication plant compliance with required QA/QC program requirements described herein.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver members tagged, unload carefully, and store in a vertical position. Handle only as recommended by the manufacturer. Protect from adverse environmental conditions until members are installed and protected by permanent enclosure.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flange material, web material and adhesives shall conform to the requirements of the I-Joist manufacturer’s ICC-ESR report.

B. Web Stiffeners and Blocking Panels: Comply with details and dimensions as shown on the drawings and as per manufacturer’s instructions.

C. Metal Bridging: Metal bridging shall be 20 gauge “TB-tension bridging” (nail type) as manufactured by Simpson Strong-Tie Company, Inc.

D. Fasteners shall be as specified in Section 06 10 00 Rough Carpentry.

2.2 FABRICATION

A. I-Joists shall be manufactured in an approved plant listed in the ICC-ESR report under the supervision of an approved third-party inspection agency.
B. Each joist shall be identified by a stamp indicating the joist type, ESR report number, manufacturer’s name, plant number, dated of fabrication, and the independent inspection agency’s logo.

C. Tolerances
   1. Depth: +/- 1/16”
   2. Flange Width: +/- 1/16”.

PART 3 - EXECUTION

3.1 INSTALLATION

A. I-joists are to be erected and installed in accordance with the structural plans, and I-Joist manufacturer drawings and installation instructions and recommendations. Temporary construction loads which cause stresses beyond design limits are not permitted.

B. Erection bracing is to be provided by the installer to keep the joists straight and plumb as required. This bracing is also to assure adequate lateral support for the individual joists and the entire system, until the sheathing material has been fully applied.

C. Nails or screws into the side of the joist flange, for the purpose of supporting pipe or other loads will only be permitted if detailed on the structural drawings.

D. No cutting or notching of the flanges will be permitted.

E. Holes shall not be cut in the web unless such holes are specifically detailed and dimensioned on the shop drawings.

F. Predrill where nails or screws tend to split I-Joist flanges.
   1. In the event of splitting, a repair procedure shall be prepared by the Contractor and submitted to DSA for review and approval on a case-by-case basis.

3.2 FIELD INSPECTION DURING CONSTRUCTION

A. The District’s Project Inspector shall:
   1. Inspect erected I-Joist framing as required to establish conformity of work with the structural drawings.
   2. Inspect all I-Joist connections.

B. Prior to enclosing the I-Joists, the Contractor shall notify the Architect and Project Inspector to provide an opportunity to review of the installation.

END OF SECTION
SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Exterior plywood as indicated.
   2. Exterior wood trim as indicated.
   3. Interior standing and running trim as indicated.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
   1. Section 09 90 00 - Painting and Coating: For field finish painting.

1.2 REFERENCES

A. APA - APA-The Engineered Wood Association

B. ASTM - American Society for Testing and Materials

C. CALGreen - California Green Building Standards, 2016 Edition

D. CFR - Code of Federal Regulations

E. EPA - Environmental Protection Agency

F. NHLA - National Hardwood Lumber Association

G. WI - Woodwork Institute

H. WRCLA - Western Red Cedar Lumber Association

1.3 SYSTEM DESCRIPTION

A. Composite wood used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Articles 5.504.4.5 and 5.504.4.5.3.
1.4 SUBMITTALS

A. Product Data: Submit for all items.

B. Samples: Provide finished samples of wood slats attached backer board.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Do not deliver interior finish carpentry until environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

B. Storage and Protection: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack plywood. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber shall bear the grade and trademark of the association under whose rules it is produced and a mark of mill identification. Lumber shall be of sound stock, thoroughly seasoned, kiln-dried to a moisture content not exceeding 19 percent, and surfaced 4 sides, except as specifically designated for items hereinafter.

1. Species
   a. Exterior: Western Red Cedar, WRCLA, clear grade; kiln dried; laid plank side; intended for transparent finish.
   b. Interior: Rift cut White Oak; intended for transparent finish; clear, low-VOC polyurethane stain to match Architect’s sample.

B. Lumber Trim Intended for Opaque Finish (Painted): Finished lumber (S4S), either finger-jointed or solid lumber, of one of the following species and grades:

1. Grade A Finish Alder, Aspen, Basswood, Cottonwood, Gum, Magnolia, Soft Maple, Sycamore, Tupelo, or Yellow Poplar, NHLA.

C. Plywood: APA, A-B Marine Grade Exterior, size as indicated on the Drawings, tongue and groove where exposed to view, with plain sliced veneer as selected by the Architect.

D. Fasteners

1. Provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A153, length of fastener embed into wood substrate to equal 1-1/2 times thickness of items fastened.

2. Countersink nails and fill surface where nailing is unavoidable. Sand smooth and flush for clear finish.

E. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
F. Multipurpose Construction Adhesive: Formulation complying with ASTM D3498 that is recommended for indicated use by adhesive manufacturer.
   1. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Putty: Linseed oil type, tinted to match surface finish color.

H. Back Priming: As specified in Section 09 90 00.

2.2 FABRICATION

A. Preparation
   1. Verify measurements at job site.
   2. Verify details and dimensions of fixtures integral with finish carpentry for proper fit and accurate alignment.

B. General Fabrication Requirements
   1. Factory-fabricate and assemble work in complete units insofar as dimensions permit shipment and installation.
   2. Kerf backs of solid members more than 5 inches wide or more than 1 inch nominal thickness.
   3. Conceal nailing where possible and set nail heads for putty in exposed portions.
   4. Perform corrective measures necessitated by non-conformance with WI standards. The Architect’s opinion shall govern discrepancies.
   5. Preprime wood and field prime end cuts.

2.3 FINISHES

A. Shop Finishing: Provide items specified in this Section to be fabricated in accordance with WI standards, shop finished, back prime all concealed wood surfaces.

B. Preparation For Site Finishing
   1. Touch-Up: Touch-up items specified to be shop finished in accordance with requirements of WI.
   2. Items Other Than Those Specified to Be Shop Finished
      b. Finish paint in accordance with requirements of Section 09 90 00.
   3. Finish MDF smooth with no visible wart or paint wicking at fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General
   1. Set work square, level, plumb with edges scribed, accurate, and secure in place with fastenings, clips, braces, brackets, anchors, shims, and blocks.
   2. Conceal nailing and screwing where possible and set nail heads for putty in exposed portion and conceal screws as indicated.
   3. Miter inside and outside corners of running trim; bevel end joints together.
B. Wood Surfaces
1. Thoroughly hand sand. Take care that cross sanding is removed by final sanding in direction of grain; ease “knife-edge” corners by sanding.
2. Ensure free from dust, glue, stains, and other foreign matter and in proper condition to receive finish.

3.2 ADJUSTING

A. Repair damaged or defective finish carpentry where possible to eliminate functional or visual defects. Where not possible to repair, replace finish carpentry. Adjust joinery for uniform appearance.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Wood casework and shelving.
2. Plastic laminate faced casework, countertops, and shelving.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
1. Section 08 80 00 - Glazing: Provision of glass and glazing.
2. Section 09 90 00 - Painting and Coating: For back priming and finish painting.
3. Section 11 40 00 - Food Service Equipment: Provision of sneeze guards at casework.
5. Division 22 - Plumbing: Provision of sinks and other plumbing fixtures and fittings for elements located in countertops including rough-in and connection to such fixtures.
6. Division 26 - Electrical: Provision of electrical fixtures and fittings for elements located in casework including rough-in and connection to such fixtures.

1.2 REFERENCES

A. ANSI - American National Standards Institute
1. A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.

B. CALGreen - California Green Building Standards, 2016 Edition

C. CFR - Code of Federal Regulations

D. EPA - Environmental Protection Agency

E. FS - Federal Specifications
1. FF-N-105 - Nails, Brads, Staples and Spikes: Wire, Cut and Wrought.

F. NEMA - National Electric Manufacturers Association
1. LD3 - High Pressure Decorative Laminates.

G. WI - Woodwork Institute
1.3 DEFINITIONS

A. Exposed Portions - All Grades: Surfaces visible when doors and drawers are closed; underside of bottoms of cabinets over 4 feet above finished floor; cabinet tops under 6 feet above finished floor; visible front edges of web frames, ends, divisions, tops, shelves, and hanging stiles.
   1. Where open shelves are indicated, tops and bottoms of adjustable shelves and inside surfaces of shelving units shall be considered as exposed.

B. Semi-Exposed Portions: Shelves behind cabinet doors; divisions; interior face of ends, backs, and bottoms; drawer sides, subfronts, backs, and bottoms; underside of bottoms of cabinets between 2-1/2 and 4 feet above finished floor; interior faces of hinged doors; and all rooms designated as storage, janitor, closet, or utility.

C. Concealed Portions: Toe space; sleepers, web frames, stretchers, and solid sub-tops; security panels; underside of bottoms of cabinets less than 2-1/2 feet above finished floor; flat tops of cabinets 6 feet or more above finished floor except if visible from upper building level; 3 non-visible edges of adjustable shelves; underside of countertops, knee spaces, and drawer aprons; faces of cabinet ends of adjoining units that butt together.

1.4 SYSTEM DESCRIPTION

A. Composite wood used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Articles 5.504.4.5 and 5.504.4.5.3.

1.5 SUBMITTALS

A. Product Data
   1. Submit manufacturer’s product data for each type of product and process specified and incorporated into items of architectural casework during fabrication, finishing, and installation, including hardware.
   2. Submit manufacturer’s written installation instructions for pre-fabricated casework items.

B. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, seismic anchorage and other components.
   1. Show details full size.
   2. Show locations and sizes of furring and blocking, including concealed backing and reinforcing specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical devices, faucets, soap dispensers, grommets, and other items installed in casework.

C. Samples
   1. Submit proposed finish panel with edge details, colors, patterns, finishes, and textures.
   2. Resubmit panel sample with finishes adjusted as directed, until material and finish are accepted.
D. Quality Control Submittals
   1. Certificates: Submit WI compliance certificates indicating that casework meets requirements of grades specified.
   2. Qualification data for firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and Cities, and other information specified.

1.6 QUALITY ASSURANCE

A. Qualifications
   1. Fabricator: Firm experienced in producing architectural casework similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.
   2. Installer: Arrange for interior architectural casework installation by a firm that can demonstrate successful experience in installing architectural casework items similar in type and quality to those required for this Project.

B. Quality Standard: Except as otherwise indicated, comply with WI for grades of interior architectural casework, construction, finishes and other requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Do not deliver casework until painting and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Do not deliver or install casework until wet-work is completed and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where casework is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Verify locations of concealed framing, backing, reinforcements, and furring that support casework by accurate field measurements before being enclosed. Record measurements on final shop drawings.
   2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating casework without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.
PART 2 - PRODUCTS

2.1 MATERIALS

A. General
   1. Material Grade: Provide materials that comply with requirements of the WI quality standard for each type of woodwork and quality grade indicated, unless otherwise indicated.
   2. Lumber and Plywood: Kiln-dry to equilibrium moisture content suitable for fabrication in shop and use intended.

B. Lumber, Solid Stock
   1. Exposed and Semi-Exposed Portions for Transparent Finish: As selected by the Architect.
   2. Concealed Portions: Birch, paint grade.

C. Plywood
   1. Exposed and Semi-Exposed Portions: As selected by the Architect.
   2. Concealed Portions: Birch veneer.
   3. At Wet Area Countertops: Marine plywood, 3/4-inch thick.

D. Medium Density Fiberboard (MDF): ANSI A208.2, 3/4-inch thick, water-resistant, paint grade, with low VOC/formaldehyde-free, as manufactured by Roseburg, “Medex”, or equal.

E. Plastic Laminate, PL-1, PL-2, and PL-3
   1. High pressure general purpose grade, solid colors or woodgrains with smooth or textured surfaces.
      a. Plastic Thickness and Grade: Meet requirements of NEMA LD3.
      b. Adhesive: As recommended by plastic laminate manufacturer.
   2. Products
      a. Typical: As manufactured by Formica; Wilsonart; Nevamar, or equal.
      b. At Café and Learning Commons: Wilsonart, “HD with Antimicrobial and Enhanced Scratch and Scuff Resistant”, or equal.
   3. Finishes/Colors: Refer to the schedule of interior finishes on Drawing Sheet A9.13.2.

F. Resin Panels: 1/4-inch thick, front finish Matte, back finish Matte White Opaque, color Glacier, as manufactured by Lumicor, “Luminous”, or equal.

G. Glass and Glazing: As specified in Section 08 80 00.

H. Solid Surfacing Countertops: As specified in Section 12 36 61.16.

I. Hardware - General Requirements
   1. Furnish necessary screws, staples, bolts or other fastenings of proper size and type to secure items in position and, where exposed, to match finish of hardware item fastened.
   2. Keying: Key groups of locks the same in accordance with the Architect’s directions.
3. Typical hardware except where specifically noted otherwise.
   a. Drawer/Door Pulls
      1) At LLRC: Stainless steel, matt, center to center 128mm, projection 1-3/8 inches; as manufactured by Hafele, “No. 104.74.062”, or equal.
      2) At Café Servery: Handle, tab, aluminum with satin finish, center to center 50mm; as manufactured by Hafele, “No. 124.02.432”, or equal.
      3) At Learning Commons: Handle, tab, aluminum with satin finish, center to center 102mm; as manufactured by Hafele, “No. 124.02.444”, or equal.
      4) At Kitchen: Stainless steel as selected by the Architect.
   b. Hinges
      1) At LLRC and Café Servery: Concealed European style, Grade II, minimum 120-degree opening, stainless steel; as manufactured by Hafele; Blum, or equal.
      2) At Kitchen: 5 knuckle projecting barrel, stainless steel mortise with 5/8-inch round corners in satin finish; as manufactured by Hafele; Blum, or equal.
      3) At Learning Commons: Continuous heavy-duty; as manufactured by Hafele; Blum, or equal.
   c. Locks: As indicated on the Drawings.
   d. Drawer Slides: Concealed full extension, 150 pounds load capacity, stainless steel with satin finish; as manufactured by Accuride; Blum, or equal.
   e. Catches: Elbow type, chrome-plated brass finish; as manufactured by Hafele; Blum, or equal.
   f. Shelf Hardware: Standards and supports, steel, zinc plated, satin finish; as manufactured by Knape and Vogt Mfg. Co.; Blum, or equal.
   g. Door and Drawer Silencers: Black rubber; as manufactured by Builders Brass Works; Ives, or equal.
   h. Latch at LLRC: Magnetic pressure, push latch for newspaper custom casework; as manufactured by Hafele; Blum, or equal.
   i. Wire Management Grommets: Extruded and machined aluminum, 3-1/2 inch overall diameter with matching aluminum cap with radius branch; as manufactured by Doug Mockett & Company; Alliance Plastics, or equal.

2.2 INSTALLATION MATERIALS

A. Screws: Select material, type, size, and finish required for each use. Comply with ANSI B18.6.1 for applicable requirements.

B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.

F. Adhesive for Bonding Plastic Laminate: Resorcinol.
   1. Adhesive for Bonding Edges: Hot melt adhesive.

2.3 WOOD CASEWORK

A. Fabricate in accordance with WI, Premium Grade.

B. WI Construction Style: Style B, Face Frame.

C. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

D. WI Door and Drawer Front Style: Stile and rail flush with face frame.

E. Wood Species and Cut for Exposed Surfaces: As selected by the Architect.
   1. Grain Matching: Run and match grain vertically for drawer fronts, doors, and fixed panels.

F. Semiexposed Surfaces: Provide surface materials indicated below:
   1. Surfaces Other Than Drawer Bodies: Match species and cut indicated for exposed surfaces.
   2. Drawer Sides and Backs: Birch.
   3. Drawer Bottoms: Birch.

G. Shelving: Where indicated, provide wood veneer-faced panel product with solid lumber edge and cleats; comply with WI Section 15, Custom Grade.
   1. Species: As selected by the Architect.
   2. Finish: Transparent.

H. Paint Materials
   1. Backprimer: As specified in 09 90 00.
   2. Finish: As specified in Section 09 90 00.

2.4 PLASTIC LAMINATE FACED CASEWORK

A. Quality Standard: Comply with WI Section 15.
   1. Grades
      a. Typical: Custom.

B. WI Construction Style: Style A, Frameless.
C. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

D. WI Door and Drawer Front Style: Flush overlay.

E. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces Other Than Tops: HGL.
   2. Post-Formed Surfaces: HGP.
   3. Vertical Surfaces: HGS.
   4. Edges: ABS edge band, color as selected by the Architect from manufacturer’s full range.

F. Materials for Semi-Exposed Surfaces: Provide surface materials indicated below:
   1. Drawer Sides and Backs: Solid hardwood lumber.
   3. At semi-exposed backs of panels with exposed plastic laminate surfaces, provide plastic laminate.
   4. At concealed backs of panels with exposed plastic laminate surfaces, provide plastic laminate.

G. Colors, Patterns, and Finishes: As selected by the Architect from laminate manufacturer’s full range of colors and finishes.
   1. Backprimer: As specified in Section 09 90 00.

H. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

I. Countertops
   1. Quality Standard: Comply with WI Section 16, Custom grade.
   2. High-Pressure Decorative Laminate Grade: HGP.
      a. Colors, Patterns, and Finishes: As selected by the Architect from manufacturer’s full range of colors and finishes.
      b. Grain Direction: Parallel to cabinet fronts, unless otherwise indicated.
      c. Edge Treatment: Wood trim as indicated on the Drawings.
      d. Core Material
         1) Typical: Medium-density fiberboard or medium-density fiberboard made with exterior glue.
         2) At Wet Areas: Marine plywood.
      e. Backer Sheet: Plastic laminate, Grade BKL, on underside of countertop substrate.

J. Shelving: Plastic laminate faced where indicated on the Drawings.
   1. Edges: ABS edge band, color as selected by the Architect from manufacturer’s full range.

2.5 FINISHING

A. Quality Standard: Comply with WI Section 5, unless otherwise indicated.
   1. Grade: Provide finishes of same grades as items to be finished.
B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural casework, as applicable to each unit of work.
   1. Backpriming: Sand and apply 1 coat of sealer or primer compatible with finish coats to concealed surfaces of casework, including backs of cabinets and underside of countertops. Concealed surfaces of plastic laminate-clad casework do not require backpriming when surfaced with plastic laminate.

C. Backprime surfaces to be set against concrete or plaster, as specified in Section 09 90 00.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition casework to average prevailing humidity conditions in installation areas before installing.

B. Before installing architectural casework, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. Quality Standard: Install casework to comply with WI for the same grade specified in Part 2 of this Section for type of casework involved.

B. Install casework plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8-inch in 96 inches for plumb and level (including tops).

C. Scribe and cut casework to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor casework to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with casework and matching final finish where transparent finish is indicated.

E. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8-inch in 96 inch sag, bow, or other variation from a straight line.

F. Countertops: Anchor securely to base units and other support systems as indicated. Caulk space between backsplash and wall with specified sealant.
   1. Install countertops with no more than 1/8-inch in 96 inch sag, bow, or other variation from a straight line.
   2. Secure backsplashes to tops with concealed metal brackets at 16 inches on center.
G. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of casework.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective casework where possible to eliminate functional and visual defects; where not possible to repair, replace casework. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust concealed hardware.

C. Clean casework on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION
SECTION 06 64 00
PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Plastic (FRP) wall panel covering, WF-1, at Café Storage and Kitchen.
B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES
A. ASTM - American Society for Testing and Materials
B. CBC - California Building Code, 2016 Edition

1.3 SUBMITTALS
A. Product Data: Submit manufacturer’s product data describing products.
B. Samples: Submit 1 sample of each type, pattern and color required.
C. Contract Closeout Submittals: Submit plastic paneling manufacturer’s printed instructions for cleaning and maintenance.

1.4 QUALITY ASSURANCE
A. Regulatory Requirements: Material shall conform to the following CBC requirements.
   1. Flame Spread (ASTM E84): 25 or less.
   2. Smoke Developed (ASTM E84): 450 or less.

1.5 PROJECT CONDITIONS
A. Environmental Requirements
   1. Minimum temperature of area to receive plastic paneling, before, during and after installation and requirements for conditioning adhesive and plastic paneling shall comply with plastic paneling manufacturer’s printed instructions.
   2. However, in no case shall area temperature be less than 50 degrees Fahrenheit 72 hours before, during and 48 hours after installation.

1.6 MAINTENANCE
A. Extra Materials
   1. Provide one 48 inch wide panel.
2. Extra stock shall be of same manufacture, type, pattern, color and lot number as installed plastic paneling.
3. Provide sheet packed for storage and marked with content, pattern and color.
4. Leave extra stock at site in orderly manner as directed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Marlite, “Standard FRP”; Crane Composites/Kemlite, or equal.

2.2 PLASTIC PANELING, WF-1

A. Plastic: Semi-rigid high impact acrylic/polyvinyl chloride sheet, Class C, 0.060-inch thick, 48 inches wide by 10 feet high sheets, with the following properties:
   1. Texture: Smooth.
   2. Color: As selected by the Architect from manufacturer’s full range.

B. Adhesive: Mildew-resistant and nonstaining to wearing surface; as supplied or recommended by reviewed plastic paneling manufacturer.

C. Caulking: Silicone caulking with color to match plastic paneling as recommended by the paneling manufacturer.

D. Accessories: Clear anodized aluminum.
   1. Joint Cover Strips: Manufacturer’s standard.
   2. Inside Corners: Manufacturer’s standard.
   3. Exposed Edges: Manufacturer’s standard surface mounted edge cap.
   4. Outside Corners: Manufacturer’s standard thermoformed corner guards typical at all outside corners.
   5. Division Bar: Manufacturer’s standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Complete all other trade work that penetrates substrate before beginning plastic paneling installation.

B. Inspect rooms and areas to be covered. Test walls for moisture content with an electric moisture meter and take corrective measures if reading is more than 5 percent.

C. Beginning of application means acceptance of existing conditions.

3.2 PREPARATION

A. Remove dirt, grease, crayon, ink or other similar markings to prevent color staining or bleeding through the plastic paneling.
B. Fill cracks, crevices and holes with compound recommended by the plastic paneling manufacturer. Sand rough spots smooth. Surfaces to be covered shall be thoroughly dry.

C. Remove and seal surfaces to be covered in accordance with plastic paneling manufacturer’s printed instructions to permit ultimate removal of plastic paneling without damaging wall surface.

3.3 APPLICATION

A. Apply adhesive and plastic paneling in strict accordance with the manufacturer’s printed instructions.

B. Apply plastic paneling to assure that:
1. Covering is applied without horizontal joints; internal and external angles are continuous.
2. Vertical joints are lapped and double cut or factory trimmed and butted.
3. Edges extend not less than 1/2-inch behind applied base and trim unless otherwise indicated.
4. Seams and corners are securely applied so no moisture or water vapor can get behind plastic paneling.
5. Panel edges, corners, butt joints, etc. are covered so that no panel edges are exposed.
6. Plastic paneling extends behind edges of switch plates and other surface mounted equipment.
7. Colors are uniform.
8. Finished surfaces are free of air pockets, wrinkles, tears and other defects.

C. Plastic Paneling: Apply with contact cement for Class A fire rating with vertical joints of beveled lap joint with 1/16-inch gap over battens.

3.4 CLEANING

A. Remove excess adhesive from each seam and wipe plastic paneling clean, removing adhesive, dirt and soiling. There shall be no residual stain after cleaning.

END OF SECTION
SECTION 07 19 00
WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and application of clear water repellent coating to exterior exposed unpainted surfaces of precast architectural concrete.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
   1. Section 03 45 00 - Precast Architectural Concrete: Provision of precast architectural concrete wall cap at trash enclosure.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

1.3 SYSTEM DESCRIPTION

A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.
   1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
      a. Hardened Concrete: ASTM C642.
   2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E96.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data including manufacturer’s specifications, surface preparation and application instructions, recommendations for water repellents for each surface specified and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

B. Samples: Submit 3 each 12 inch by 12 inch samples on cast-in-place concrete and unit masonry surfaces.

C. Quality Control Submittals
   1. Test Reports: Submit material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of water repellents with Performance Requirements specified in the "Quality Assurance" article.
2. Certificates: Submit certification by water repellent manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC).

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable rules of the pollution-control regulatory agency having jurisdiction in the Project locale regarding volatile organic compounds (VOC) and use of hydrocarbon solvents.

1.6 PROJECT CONDITIONS

A. Weather and Substrate Conditions: Do not proceed with application of water repellent (except with written recommendation of manufacturer) under any of the following conditions:
   1. Ambient temperature is less than 40 degrees Fahrenheit and greater than 95 degrees Fahrenheit.
   2. Substrate surfaces have cured for less than 1 month.
   3. Rain or temperatures below 40 degrees Fahrenheit are predicted for a period of 24 hours.
   4. Earlier than 24 hours after surfaces became wet.
   5. Substrate is frozen or surface temperature is less than 40 degrees Fahrenheit.
   6. Windy condition such that repellent may be blown to vegetation or substrates not intended.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Evonik Degussa Corporation, “Protectosil Chem-Trete PB100 Water Repellent”, or equal.

2.2 WATER REPELLENTS

A. Silanes: Penetrating water repellent. A monomeric compound containing approximately 40 percent alkyltrialkoxysilanes with alcohol, mineral spirits, water or other proprietary solvent carrier.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.
   1. Formed Concrete: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of water repellents.

B. Test for pH level, according to water repellent manufacturer’s written instructions, to ensure chemical bond to silicate minerals.
C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass. Immediately clean water repellent from adjoining surfaces, complying with manufacturer’s cleaning recommendations.

D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured.
   1. Water repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

3.2 APPLICATION

A. Apply a heavy saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer’s written instructions for using airless spraying procedure, unless otherwise indicated.

B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer’s written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

C. Remove protective coverings from adjacent surfaces.

END OF SECTION
SECTION 07 21 01
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Thermal and acoustical insulation.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 07 21 19 - Foamed-In-Place Insulation: Provision of foamed-in-place insulation.
   2. Section 07 52 16 - SBS Modified Bituminous Membrane Roofing: Provision of SBS-modified bituminous membrane roofing system.
   3. Section 07 84 00 - Firestopping: Provision of firestopping.
   4. Section 09 24 00 - Cement Plastering: Provision of exterior portland cement plasterwork.
   5. Section 09 29 00 - Gypsum Board: Provision of gypsum board.
   7. Section 09 90 00 - Painting and Coating: Provision of top coat at thermal barrier at roof.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

B. CALGreen - California Green Building Standards, 2016 Edition

C. CBC - California Building Code, 2016 Edition

1.3 DEFINITIONS

A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by “r-values”, they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees Fahrenheit between the 2 exposed faces required to cause 1 BTU to flow through 1 square foot per hour at mean temperatures indicated.
1.4 SYSTEM DESCRIPTION

A. Insulation used on the Project shall comply with CALGreen Code Nonresidential Voluntary Measures Appendix A5, Division A5.5, Section A5.504, Articles A5.504.4.8 and A5.504.4.8.2.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for insulation products specified.

B. Certifications: Submit certification that insulation was furnished and installed in accordance with CBC requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer’s recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Thermal Cavity Insulation at Exterior Walls
   1. Unfaced, friction-fit, flexible batt or blanket of fiberglass, width to fit stud space, formaldehyde-free, 25 percent recycled content, conforming to ASTM C665, Type I, non-combustible when tested in accordance with ASTM E136, having thermal resistance rating of R-19, unless otherwise indicated, and the following fire resistive requirements when tested in accordance with ASTM E84:
      a. Flame Spread: 25 or less.
      b. Smoke Developed: 50 or less.
   2. Product: As manufactured by Johns Manville; Certainteed Corporation; Owens Corning, or equal.

B. Thermal Insulation at Exterior Walls, Rigid Continuous
   1. Graphite polystyrene (GPS) board, ASTM C578, Type II; high density with nominal density of 1.5 pcf (1.35 pcf minimum); having the following fire resistive requirements when tested in accordance with ASTM E84:
      a. Flame Spread: 25 or less.
      b. Smoke Developed: 450 or less.
   2. Thickness: 1-1/2 inches, unless otherwise indicated.
   3. Thermal Resistance: Minimum R-4.6 per inch.
   4. Minimum 40 psi flexural, minimum 20 psi compressive, minimum density 1.45 pcf.
   5. Minimum vapor permeance 3.1 perms.
   6. Maximum size 2 feet by 8 feet installed horizontally using plastic washer type fasteners at 24 inches on center maximum. Vertical joints shall be staggered minimum 16 inches. Gaps between boards shall not exceed 3/16-inch.
   7. Provide custom shapes are required.
C. Acoustical Wall Insulation
1. Unfaced, minimum 3-1/2 inches thick or as required to fill stud cavity, friction-fit, formaldehyde-free, flexible batt or blanket of fiberglass, width to fit wall stud, and conforming to ASTM C665, Type I, non-combustible when tested in accordance with ASTM E136 and having the following fire resistive requirements when tested in accordance with ASTM E84.
   a. Flame Spread: 25 or less.
   b. Smoke Developed: 50 or less.
2. Provide batts to full depth of wall studs; size insulation to fit minimum 2x6 metal studs.
3. Product: As manufactured by Johns Manville; Certainteed Corporation; Owens Corning, or equal.

D. Acoustical Ceiling Insulation
1. Unfaced, 3 inches thick, moisture-resistant mineral wool sound attenuation batts, conforming to ASTM C665, Type I, non-combustible when tested in accordance with ASTM E136 and having the following fire resistive requirements when tested in accordance with ASTM E84.
   a. Flame Spread: 0.
   b. Smoke Developed: 0.
2. Sound Control: Absorbs sound and improves assembly STC ratings by up to 10 dB.

E. Black-Faced Insulation at Linear Wood Ceilings: Semi-rigid (2 lbs./cu. ft.) fiberglass with black protective matt facing, as manufactured by Johns Manville, “Insul-Shield Black”; Owens Corning, “SelectSound Black Acoustic Blanket”; CertainTeed, “AcoustaBlanket Black”, or equal.

F. Accessories
1. Insulation Tape: Pressure-sensitive tape of type recommended by insulation manufacturer for sealing joints and penetrations in insulation.
2. Insulation Support: Galvanized springwire as required and as recommended by insulation manufacturer.
3. Primers and Sealers: As recommended by the insulation manufacturer.
4. Fiberglass Cloth: Plain weave, 10 ounces, Style 7500, white, as manufactured by BGF Industries, Inc.; Orca Composites, “Product #OC027”; Fibre Glast Development Corp., or equal.
   a. Install with staples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.
3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer’s instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer’s technical representative for specific recommendations before proceeding with installation of insulation.

B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

C. Apply a single layer of insulation of required thickness at wall locations, unless otherwise shown or required to make up total thickness.

D. Tape joints and ruptures in insulation, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

3.3 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrate by method indicated, complying with manufacturer’s recommendations. If no specific method is indicated, use mechanical anchorage to provide permanent placement and support of units.

B. Maintain required separations from electric fixtures and appliances.

C. For framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

D. Repairs to Existing Thermal Insulation: Where existing thermal insulation is adversely affected by work of this Project, maintain thermal barrier R-value by repairing with insulation materials of equal or greater thermal resistance rating.

3.4 ACOUSTICAL INSULATION

A. Install at all sound-rated construction including walls and floor/ceiling assemblies where indicated.

3.5 PROTECTION

A. General: Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Foamed-in-place thermal insulation.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 07 21 01 - Building Insulation: Provision of thermal and acoustical batt insulation.
   2. Section 07 52 16 - SBS Modified Bituminous Membrane Roofing: Provision of SBS-modified bituminous membrane roofing system.
   3. Section 09 90 00 - Painting and Coating: Provision of top coat at thermal barrier at roof.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

B. CALGreen - California Green Building Standards, 2016 Edition

C. CBC - California Building Code, 2016 Edition

1.3 DEFINITIONS

A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by “r-values”, they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees Fahrenheit between the 2 exposed faces required to cause 1 BTU to flow through 1 square foot per hour at mean temperatures indicated.

1.4 SYSTEM DESCRIPTION

A. Insulation used on the Project shall comply with CALGreen Code Nonresidential Voluntary Measures Appendix A5, Division A5.5, Section A5.504, Articles A5.504.4.8 and A5.504.4.8.2.

B. Environmental Requirements
   1. Comply with manufacturer's recommended temperature and substrate requirements during application and curing of the product. Substrate must be clean, dry, firm, free of loose particles and free of dust, grease and mold release agents. Protect surfaces not to be foamed.
2. Provide adequate ventilation where the product is being applied to help control worker exposure to airborne contaminants.
3. Consult the manufacturer's Material Safety Data Sheets, product stewardship guidelines, and operating instructions before use.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including preparation instructions and recommendations, storage and handling requirements and recommendations, and installation methods.

B. Certifications: Submit certification that insulation was furnished and installed in accordance with CBC requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Provide qualified installers familiar with the application and products being used per manufacturer's guidelines.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a dry location. Comply with manufacturer’s operating and technical instructions for storage, handling, and personal protection information prior to and during product installation.

B. Do not store full tanks above 100 degrees Fahrenheit. Storage of partial or used tanks above 90 degrees Fahrenheit for extended periods may reduce the shelf life of the product. Avoid long-term storage in direct sunlight or near sources of heat.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Thermal Insulation at Roof
1. High R-value, spray-in-place, low density, open celled, flexible, nominal 0.7 lbs/ft³ density, 100 percent water-blown polyurethane foam insulation; low-VOC; having the following fire resistive requirements when tested in accordance with ASTM E84:
   a. Flame Spread: 20 or less.
   b. Smoke Developed: 450 or less.
B. Thermal Barrier at Roof

1. Single-component, water-based intumescent coating designed for application as an ignition barrier over spray foam products in attics and crawlspaces; color gray.
   a. Provide water-based paint top coat as specified in Section 09 90 00.

2. Apply to thickness as required by ESR test report specific to insulations specified.

   a. Shall be approved by insulation manufacturer’s ESR reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Substrate shall be clean, dry, firm, free of loose particles, and free of dust, grease, and mold release agents.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Product shall be installed according to local code.

C. Follow ambient and substrate temperature range recommendations when applying the product.

D. Roof insulation shall be installed in multiple layers with joints staggered.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. For exterior applications, provide a coating or painting for protection from UV radiation.
C. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Vapor retarder below slab on grade.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 03 10 00 - Concrete Forming and Accessories: Provision of concrete formwork.
   2. Section 03 20 00 - Concrete Reinforcing: Provision of concrete reinforcement.
   3. Section 03 30 00 - Cast-In-Place Concrete: Provision of cast-in-place concrete.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials
   3. E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
   4. E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

B. FS - Federal Specifications
   1. SS-C-153C - Cement, Bituminous, Plastic.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for vapor retarder specified, including compliance with applicable ASTM standards.

B. Testing: Provide 3rd party documentation that all testing was performed on a single production roll in accordance with ASTM E1745, Section 8.1.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for Vapor Retarder Products: Obtain vapor retarder from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect vapor retarder materials from puncture damage. Comply with manufacturer’s recommendations for handling, storage, and protection during installation.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Retarder
   1. Provide vapor retarder of 3 ply, minimum 15 mils, high-density polyethylene copolymer and nylon yarn laminate, with yarn suspended in a permanently flexible adhesive media. Material shall have a reinforced non-woven grid with a PPT tear strength of not less than 15 pounds, as determined by ASTM D2582, and a water vapor transmission rate (WVTR) of 0.01 perms, as determined by ASTM E96. Provide in widest rolls practical to minimize joints, as manufactured by Stego Industries, “15 Mil Stego Wrap”; Epro Waterproofing Systems, “Ecoshield-E”; W. R. Meadows, Inc., “Perminator”, or equal.
   2. Tape for Vapor Retarder: Pressure sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder; minimum width of 4 inches.


PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of vapor retarder are satisfactory. Do not proceed with installation of retarder until unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer’s instructions.
B. Level, tamp, or roll earth or granular material beneath the slab base.
C. Coordinate with installation of concrete reinforcing and cast-in-place concrete.

3.3 INSTALLATION

A. General
   1. Install in accordance with ASTM E1643 and manufacturer’s instructions.
   2. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place. Extend vapor retarder to cover miscellaneous voids in substrates.

B. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.

C. Seal vapor retarder to the entire slab perimeter and footing/grade beam per manufacturer’s instructions. Concrete shall be clean and dry prior to adhering tape.
D. Lap all seams 6 inches and seal all joints in the field with the specified pressure sensitive tape. Heat-welded joints done in a shop prior to delivery is an acceptable method to minimize the number of field joints.

E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with tape of type recommended by vapor retarder manufacturer to create an airtight seal between penetrating objects and vapor retarder.
   1. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.

F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with tape or another layer of vapor retarder overlapping damaged area 6 inches and taping all 4 sides with tape.

G. Vapor retarder manufacturer’s representative shall perform site visits as needed to observe the installation of the vapor retarder. Site visits shall, at a minimum, include one at start of installation and one at completion of installation. Manufacturer’ representative shall provide site visit reports for each site visit and submit to the District for review. Placement of concrete shall be contingent upon the District’s approval of the report on the completed installation of the vapor retarder system.

3.4 PROTECTION

A. General: Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION
SECTION 07 27 15

SELF-ADHERING SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   2. Self-adhering, vapor-impermeable air barrier flashing.

B. Related Sections:
   1. 079200 Joint Sealants

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; and tested physical and performance properties of products.

B. Sustainable Design Submittals:
   1. Product Data: For coatings, indicating VOC content.
   2. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For air-barrier assemblies.
   1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
   2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
B. **Product Certificates:** From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

C. **Product Test Reports:** For each air-barrier assembly, for tests performed by a qualified testing agency.

D. **Field quality-control reports.**

### 1.5 QUALITY ASSURANCE

A. **Installer Qualifications:** An entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. **Mockups:** Build mockups to set quality standards for materials and execution.
   1. Build integrated mockups of exterior wall assembly as indicated on Drawings, incorporating backup wall construction, window, storefront, door frame, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
      a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
      b. Include junction with roofing building corner and soffit conditions, and foundation wall intersection.
      c. If barrier/retarder manufacturer’s representative or Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

### 1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.8 WARRANTY

A. Special Warranty, General: Manufacturer's standard project-specific form in which manufacturer agrees to repair or replace air barrier coatings and accessory products that demonstrate deterioration or failure within warranty period specified due to material failure under normal use. Failure includes water or air penetration through air barrier assembly.
   1. Warranty Period: Five years from date of Substantial Completion.

B. Installer’s Special Warranty: Installer’s standard form in which installer agrees to repair or replace components of air barrier systems that fail in workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.3 NONBITUMINOUS SHEET AIR BARRIER, VAPOR PERMEABLE

A. Nonbituminous Sheet: Minimum 20-mil-thick, self-adhering sheet consisting of a breathable carrier film or fabric and an adhesive with release liner on adhesive side and formulated for application with primer that complies with VOC limits.
   1. Products:
      a. Basis of design: Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier VPS.
      b. VaproShield Wrapshield SA Self-adhered.
      c. Soprema Sopraseal Stick VP
   2. Physical and Performance Properties:
a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.

b. Puncture Resistance: Minimum 40 lbf; ASTM E 154/E 154M.

c. Vapor Permeance: Minimum 15 perms; ASTM E 96/E 96M, Desiccant Method, Procedure A.

d. Adhesion to Substrate: Minimum 15 lbf/sq. in. when tested according to ASTM D 4541 as modified by ABAA.

e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

f. UV Resistance: Can be exposed to sunlight for 150 days according to manufacturer’s written instructions.

2.4 PRIMER

A. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.


2. VOC Content: 100 g/L or less.

2.5 NON-PERMEABLE SELF-ADHERED FLASHING

A. Non-permeable detail membrane, from the same manufacturer as the vapor permeable sheet above, intended for use at rough openings and low-slope surfaces.

B. Provide foil-faced self-adhered flashing accessory from same manufacturer providing the sheet air barrier.

2.6 ACCESSORY MATERIALS

A. Requirement: Provide transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Liquid Membrane for Details and Terminations: Two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes.

1. Grace Construction Products; Bituthene Liquid Membrane.

C. Substrate Patching Membrane: Two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes.

1. Grace Construction Products; Bituthene Liquid Membrane.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
   3. Verify that substrates are visibly dry and free of moisture.
   4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth trowel-cut mortar joints, struck full and flush. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.

H. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

I. Bridge isolation joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.
3.3 SILL FLASHING

A. At window sills and other horizontal elements which may retain water, provide non-permeable flashing.

B. Continuously seal seams and laps of the sill flashing.

3.4 INSTALLATION

A. Install materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

B. Prepare, treat, and seal inside and outside corners and vertical and horizontal surfaces at terminations and penetrations with termination mastic.

C. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

D. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 2-inches-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
   1. Apply sheets in a shingled manner to shed water.
   2. Roll sheets firmly to enhance adhesion to substrate.

E. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inches-wide, transition strip.

F. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

G. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

H. Connect and seal exterior wall air-barrier sheet continuously to concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

I. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

J. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

K. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply silicone transition strip so that a minimum of 3 inches of coverage
is achieved over each substrate. Maintain 3 inches of contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.

L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier material with foam sealant.

M. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.

N. Do not cover air barrier until it has been tested and inspected by testing agency.

O. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA’s Quality Assurance Program.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air-barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed.
7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Air barrier has been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (air barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests: As determined by testing agency from among the following tests:

D. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer’s written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer’s written instructions.

F. Prepare test and inspection reports.

### 3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer’s written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer’s written instructions.

2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 27 15
SECTION 07 32 16
CONCRETE ROOF TILES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Patching of existing concrete roofing tiles.
2. New concrete roof tiles and accessories for complete water-tight and air-tight roof installation.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
1. Section 06 10 00 - Rough Carpentry: Provision of exterior grade fire-retardant treated plywood sheathing at existing building and exterior grade non-fire-retardant treated plywood sheathing at new building.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of sheet metal items associated with concrete roofing tiles.
3. Section 07 62 01 - Roof Underlayment: Provision of underlayment and flashing at new roof tiles.
4. Division 23 - Heating, Ventilating, and Air Conditioning (HVAC): Provision of HVAC work to be performed above and penetrating roof.
5. Division 26 - Electrical: Provision of electrical work to be performed above and penetrating roof.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

B. CBC - California Building Code, 2016 Edition

C. FMA - Factory Mutual Associates

D. ICBO - International Conference of Building Officials
1. UBCS - Uniform Building Code Standards
   a. 15-5 - Roof Tile.

E. NRCA - National Roofing Contractors Association
1.3 SYSTEM DESCRIPTION


B. Performance Requirements: Provide anchorage system of roofing tiles that is designed to comply with requirements as specified in Article title “Regulatory Requirements” in this Section.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s literature completely describing products.

B. Shop Drawings: Submit drawings showing methods of installation, including details of methods of attachment of insulation, plywood, underlayment, and tile to adjacent materials and substrates.

C. Samples: Submit 2 or more typical tiles as required to show color range for acceptance of color and surface.

D. Quality Control Submittals
   1. Certificates of Compliance: Submit certificate certifying that materials conform to cited standards.
   2. Manufacturer’s Instructions: Submit manufacturer’s installation instructions.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Wind Loading: Dead loads and live loads caused by pressure and suction of wind for design pressure in pounds per square foot shall be in accordance with CBC and the following:
      a. Exposure: C.
      b. Design Wind Pressure: As indicated on the Structural Drawings.
   2. Seismic Requirements: Comply with lateral displacement requirements of CBC.
   3. Roofing Construction
      a. Securing and Fastening: Provide roofing construction that is secured and fastened with requirements of CBC.
      b. Roof Covering Requirements: Provide roof covering that complies with requirements of CBC.
      c. Roof Covering Classification: Provide roof covering that is rated Class A in accordance with CBC.
      d. Roof Covering Materials and Application: Provide concrete tile roofing system that complies with CBC.
      e. Fasteners and Wire: Comply with requirements of CBC.
B. Mockups
   1. Build mockups as directed by the Architect to demonstrate aesthetic effects and qualities of materials and execution.
      a. At Existing Building: Provide mockup to observe color and texture of new concrete roof tiles next to existing concrete roof tiles.
      b. At New Building: Provide mockup to observe color and texture of new roof tiles; location to be determined by Architect and the District.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

A. Special Concrete Roof Tile Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace tile that fails in materials within specified warranty period. Material failures include manufacturing defects that result in leaks.
   1. Warranty Period: 50 years from date of Substantial Completion.

B. Special Roofing Installer's Warranty: Roofing Installer's warranty, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of concrete tile roofing that fail in materials or workmanship.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Eagle Roofing, “Bel Air Series, Flat Profile Tile with Flat Type Trim Tile and Flat Smooth Hip Starters”, or equal.

2.2 MATERIALS

A. Roofing Tiles at Existing Building: Contractor shall field verify and match existing tiles.
   1. Type: Concrete tile.
   2. Dimensions: Match existing.
   3. Color: Match existing.

B. Roofing Tiles at New Building: Provide all applicable accessory tiles for complete installation.
   1. Type: Concrete tile, standard weight.
   3. Color: As selected by the Architect from manufacturer’s full range of blends to meet T24 cool roof requirements.

C. Plywood Sheathing: As specified in Section 06 10 00.
   1. At existing building, if required for repair, provide exterior grade fire-retardant, pressure-treated sheathing to match existing.
   2. At new building, provide exterior grade non-fire-retardant treated plywood sheathing as indicated on the Structural Drawings.

E. Flexible Flashing at Existing Building: Self-adhering, 30 mil thick composite of aggressive butyl rubber based adhesive backed by a layer of high density cross laminated polyethylene with a service temperature of up to 300 degrees Fahrenheit.

F. Underlayment and Flashing at New Building: As specified in Section 07 62 01.

G. Cements, Sealants and Mastic
   2. Sealant: Silicone type complying with ASTM D1002.
   3. Mastic: Type as recommended by tile manufacturer.
   4. Adhesive: Concrete tile adhesive shall be identified by manufacturer as specifically formulated as a concrete roof tile adhesive, if used.

H. Batten Strips: Nominal 1 inch by 2 inches by 48 inches long, complying with CBC, Chapter 15, and installed in accordance with manufacturer’s recommendations or CBC Chapter 15, whichever is more restrictive.
   1. Provide metal batten extender.

I. Fasteners
   1. At Plywood: Type as recommended by tile manufacturer that is FMA approved for Wind-Storm Resistance Classification I-90.
   2. At Tiles: Stainless steel ring-shank nails, minimum 11 gauge, 5/16-inch head, sizes as recommended by tile manufacturer for substrate indicated.

J. Tile Vents and Eave Closures: Manufacturer’s recommended non-corroding screen vents and solid eave closures as required for application.

K. Metal Eave Riser: Comply with TRI manual MC-10B, color black.

L. Rake and Ridge Flashing: Prefinished metal, minimum 0.019-inch, galvanized G90, or as otherwise recommended by TRI manual.

M. Weatherblocking at Ridges and Hips: As manufactured by Boral, “Zephyr Block”; Verde Industries, Inc., or equal.

2.3 FABRICATION

A. Factory Fabrication
   1. Fabricated to sizes and shapes as indicated.
   2. Provide tiles having 3 inch headlap.

B. Factory Finishing: Color as selected by the Architect.
PART 3 - EXECUTION

3.1  EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Examine roof sheathing to verify that rotten wood is not present.
   2. Prior to installation of new concrete tiles, prepare written survey of existing concrete tiles to remain; record broken tiles that need to be replaced.
      a. Prepare additional written survey at the end of installation to record any tiles that were broken during the course of the work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2  PREPARATION

A. Sheet Metal Installer: Supervise installation of sheet metal flashings and coordinate installation of other sheet metal work that is integrated or adjacent to tile installation.

B. Surface Preparation
   1. Plywood: Secure plywood in accordance with approved fastening pattern as required to comply with requirements of FMA Wind-Storm Resistance Classification I-90.
   2. Underlayment
      a. Apply 1 layer of underlayment side lapped minimum 2 inches and end lapped minimum 6 inches.
      b. Secure underlayment with roofing cement to hold underlayment in place until roofing tile application.
      c. Seal edges of underlayment with roofing cement.
   3. Flashings: Supervise installation of sheet metal flashings at roof valleys and other areas as indicated.

3.3  INSTALLATION

A. General
   1. Install tiles in accordance with manufacturer’s installation instructions and CBC.
   2. Ensure that both horizontal and vertical alignment is maintained.
   3. Do not install cracked or broken tile.
   4. Penetrations: Cut tiles neatly to fit to or around roof penetrations and other vertical surfaces.
   5. At Hips and Valleys: Exercise care when cutting hip or valley tile to ensure integrity of finished installation.
   6. Upon completion, ensure sound, whole, clean and water-tight installation.
   7. Perform water testing as recommended by the roofing system manufacturer.

B. Chalk Lines
   1. Chalk horizontal and vertical guide lines on membrane to assure watertightness and proper appearance.
   2. Space chalk lines by measuring delivered tiles for average length and width exposures.
   3. Do not exceed exposure length of 1/4-inch beyond average.
C. Batten Strips: Apply in accordance with roof tile manufacturer’s written instructions; provide 1/2-inch space between ends for drainage.

D. Roofing Tile
   1. Eave Closures
      a. At eave end of tiles, install closures at each tile.
      b. Seal space between closures and tile completely with sealant.
      c. Install manufacturer’s closures, such that tiles are raised 1 inch above substrate.
   2. Tiles
      a. Install first row 13 inches from eave, leaving 1 inch overhang; length exposure shall not exceed 16 inch centers, and width exposure shall not exceed 12 inch centers.
      b. Install tile in rows from left to right, beginning at lower left corner of roof.
         1) Start at lower left corner with gable tile.
         2) Secure each row of field tile with screws.
         3) Install ridge, hip and valley tile with screws for tile, with minimum of 2 fasteners per tile.
   3. Avoid Color Patterning, Checkerboarding, Spotting and Stairstepping: Comply with the following:
      a. After installation of each 80 roofing tiles, make visual inspection from ground level and at distance from building of about 40 feet.
      b. Verify that tile courses follow straight and true lines.
      c. Verify that color range is smooth with no abrupt changes.
      d. Make necessary corrections before proceeding with further installation.

3.4 ADJUSTING

A. Replace, rework, or otherwise make good as required tiles found defective as follows:
   1. Items broken, damaged or defaced.
   2. Incomplete, misaligned or incorrectly located items.

END OF SECTION
SECTION 07 52 16

STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation, supply, and installation of roofing membrane at roofs which will only be accessed by maintenance personnel:
   1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
   2. Polymethyl methacrylate (PMMA) fluid-applied flashing.
   3. Roof Insulation.
   4. Cover Board.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
   6. Review structural loading limitations of roof deck during and after roofing.
   7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
   8. Review governing regulations and requirements for insurance and certificates if applicable.
   9. Review temporary protection requirements for roofing system during and after installation.
10. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, roofing-system manufacturer’s literature, including written instructions for evaluating, preparing, and treating substrate; technical data including tested physical and performance properties; and application instructions.
   1. Membrane and base flashing materials, and roofing cement, primer, mastic sealant, and fasteners.
   2. Temperature ranges for storage and applications of materials, and special cold-weather application requirements or limitations.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Crickets, saddles, and tapered edge strips, including slopes.
   4. Insulation fastening and adhesive patterns for corner, perimeter, and field-of-roof locations.
   5. Proposed temporary, watertight, tie-off details for each substrate type.
   6. Fastening and adhesive requirement needed at corners, edges, and field of roof.

C. Samples for Verification: 3-inch-by-4-inch samples for the following products:
   1. Cap sheet, of color required.
   2. Flashing sheet, of color required.
   3. Walkway pads or rolls, of color required.
   4. Stepped fluid-applied PMMA roofing with embedded fleece reinforcing.
   5. Roof insulation, each type.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and testing agency.
   1. Include letter from manufacturer indicating Installer is acceptable and will qualify for specified warranty.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with specified requirements.
   1. Written approval by membrane manufacturer for use and performance of membrane over specified board insulation, including that materials supplied for project comply with requirements of cited ASTM standards. Approval should also indicate materials are suitable for ASTM E 108, Class A roof and meet specified wind uplift classification.
   2. Submit evidence of meeting performance requirements.
   3. Certify that materials are free of asbestos.

C. Product Test Reports: For components of membrane roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.
D. Research/Evaluation Reports: For components of membrane roofing system, from ICC-ES.

E. Sample Warranties: Copy of roofing-system manufacturer’s warranty, stating obligations, remedies, limitations, and exclusions.

F. Maintenance Data: For roofing system to include in maintenance manuals.

G. Following completion of Work, submit roofing-system manufacturer’s inspection report of completed roofing installation and completed warranty; submit Installer’s completed warranty.

H. Field Test Reports
   1. Concrete internal relative humidity test reports.
   2. Fastener-pullout test reports and manufacturer’s revised requirements for fastener patterns.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Roofing-system manufacturer with at least 10-years documented experience for roofing system identical to that specified for this Project.

B. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing or manufacturer approved in writing by membrane roofing manufacturer.

C. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer’s product and that is eligible to receive manufacturer's special warranty.
   1. Employ foreman with minimum 5 years of experience as foreman on similar projects, who is fluent in English, to be on Site at all times during Work. Do not change foremen during course of Project except for reasons beyond control of Installer; inform Architect/Engineer in advance of any changes.
   2. Torch Safety: Crew members handling torches shall be trained by an Authorized Certified Roofing Torch Applicator (CERTA) Trainer, be certified according to CERTA torch safety guidelines as published by the National Roofing Contractors’ Association (NRCA), and follow torch safety practices as required by the contractor's insurance carrier.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer’s written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.8 FIELD CONDITIONS

A. Verify dimensions and details prior to installation of materials. Notify Owner’s Representative of conditions found to be different than those indicated in Contract Documents. Architect/Engineer will review situation and inform Contractor and Installer of changes.

B. Comply with Owner’s Representative’s limitations and restrictions for site use and accessibility.

C. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer’s written instructions and warranty requirements.

D. Torch Safety: Follow CERTA torch safety guidelines as published by the National Roofing Contractors’ Association (NRCA).

E. Maintain adequate ventilation during preparation and application of roofing materials.

1.9 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
   1. Written warranty signed by the roofing-system manufacturer, including:
      a. Repair or replacement of roofing system components that do not comply with requirements; that do not remain watertight; that fail in adhesion, cohesion, or general durability; or that deteriorate in manner not clearly specified by submitted roofing-system manufacturer’s data as an inherent quality of material for application indicated.
      b. Damage due to wind up to the specified design wind loads.
      c. Labor and materials to perform warranty work.
   2. Warranty Period: 15 years from date of Substantial Completion.

B. Roofing Installer’s Warranty:
   1. Written warranty, signed by Roofing Installer, including:
      a. Repair or replacement of roofing system components that do not comply with requirements; that do not remain watertight; that fail in adhesion, cohesion, or general durability.
      b. Removal and replacement of membrane roofing sheets, base flashings, roof insulation, fasteners, cover boards, roofing accessories, walkway products, and other components of roofing system.
c. Labor and materials to perform warranty work.

2. Warranty Period: 5 years from date of completion of roofing system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

B. Subject to compliance with requirements, provide basis-of-design system as manufactured by:
   1. Siplast

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures. Allowable stress design pressures as determined per ASCE 7-10.
   1. Corner Uplift Pressure: 35.4 lbf/sq. ft.
   2. Perimeter Uplift Pressure: 35.4 lbf/sq. ft.

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.
2.3 DESCRIPTION OF SYSTEMS

A. Basis of Design: Siplast specification 2030 IA. Two-ply cold adhesive applied SBS-modified asphalt sheet, reinforced with glass fibers, granule surface, over tapered insulation and cover board.
   1. Insulation: Polyisocyanurate. Siplast Paratherm, tapered to provide 1/4” per foot slope, adhered using Siplast Para Stick Insulation Adhesive.
   3. Roofing Membrane: SBS-modified bituminous sheet, 2-ply cold adhesive applied.
      a. Backer sheet: Siplast Paradiene 20 SA backer sheet and reinforcing ply
      b. Granule-surfaced flashing sheet: Siplast Paradiene FR BW flashing ply

2.4 ROOFING SHEET MATERIALS

A. Roofing Membrane Base Ply Sheet: ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers); smooth surfaced; suitable for application method specified.

B. Granule-Surfaced Roofing Cap Sheet: ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers); granule surfaced; suitable for application method specified, and as follows:
   1. Surfacing: ceramic granules
      a. Granule Color: White (Cool Roof, per CEC-Title 24)

2.5 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers); smooth surfaced; suitable for application method specified.

B. Granule-Surfaced Flashing Sheet: ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers); granule surfaced; suitable for application method specified, and as follows:
   1. Surfacing: ceramic granules
      a. Granule Color: To match cap sheet granule color.

2.6 LIQUID-APPLIED FLASHING MATERIALS

A. System Description: A specialty flashing system consisting of a liquid-applied, fully reinforced, multi-component acrylic membrane installed over a prepared or primed substrate. The flashing system consists of a catalyzed polymethyl methacrylate primer, basecoat and topcoat, combined with a non-woven polyester fleece. The use of the specialty flashing system shall be specifically approved in advance by the membrane manufacturer for each application.
B. Fleece Reinforcement: A non-woven, 110 g/m², needle-punched polyester fabric reinforcement as supplied by the membrane system manufacturer.

2.7 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with BAAQMD limits for VOC content

B. Asphalt Primer: ASTM D 41.

C. Cold-Applied Adhesive: Roofing system manufacturer’s standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with base flashings.

D. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

E. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

G. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing.

H. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.8 ROOF INSULATION

A. Rigid Insulation

1. Provide preformed insulation boards that comply with requirements and reference standards, selected from insulation manufacturer’s standard sizes and of thicknesses indicated on Drawings.

2. Polysiocyanurate boards: ASTM C1289, Type II, Class 1, Grade 2 or 3, felt or glass fiber mat facer on both major surfaces, 20 pounds per square in minimum compressive strength.

3. Factory tapered insulation boards prefabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
4. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Provide slopes indicated on the drawings.

2.9 RIGID INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Insulation adhesive: insulation manufacturer’s recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows.
   1. Bead applied, low rise, one component polyurethane adhesive.
   2. Siplast Para Stik Insulation Adhesive.

C. Insulation Cant Strips: ASTM C 728, perlite insulation board.

D. Tapered Edge Strips: ASTM C 728, perlite insulation board.


F. Substrate Joint Tape: 6 or 8 inch wide, coated, glass fiber.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
   4. Verify that concrete substrate is visibly dry and free of moisture.
      a. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
      b. Test that the concrete is not more than 75 percent, or as recommended by the roofing manufacturer, when tested according to ASTM F2170 at frequency of one probe per each 1,000 square feet of roof deck.
   5. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION AND COORDINATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Ensure that roof-drains are operational when no work is taking place or when rain is forecast.

C. Coordinate Work to ensure that new insulation and roofing materials are kept continuously dry and that continuous, watertight, new roofing system is provided. Coordinate:
   1. With other trades to avoid or minimize work on, or in immediate vicinity of, installation in progress and completed new roofing.
   2. To avoid or minimize adverse effects on completed new roofing.

A. Prime concrete surfaces per the manufacturer’s instructions and allow primer to dry thoroughly.

3.3 INSTALLATION, GENERAL

A. Comply with roofing system manufacturer's written instructions.

B. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer’s written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:
   1. Deck Type: Plywood.
   3. Number of SBS-Modified Asphalt Sheets: Two

B. Start installation of roofing in presence of manufacturer's technical personnel.

C. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
   1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
   2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.
D. Provide venting of the roof membrane perimeter or field areas per the manufacturer’s published recommendations.

E. Install mechanical fasteners and base sheet per manufacturer’s published recommendations. Provide quantity and pattern of fastening to meet the specified wind loads.

3.5 RIGID INSULATION AND COVER BOARD INSTALLATION

A. General: Comply with manufacturer’s written instructions for adhering insulation and cover boards as required to meet specified wind uplift.

B. Insulation Installation:
1. Comply with roofing-system manufacturer’s written instructions for installing insulation.
2. Coordinate installation so insulation is not exposed to precipitation or left exposed at end of workday.
3. Install tapered insulation to conform to slopes indicated.
4. Install insulation with long joints in continuous, straight line; with end joints staggered between rows; and abutting edges and ends between boards.
   a. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   b. Fill gaps exceeding 1/4 inch with insulation.
5. Install one or more layers of insulation to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer at least of 6 inches in each direction.
6. Trim surface of insulation where necessary at roof drains so finished surface is flush with top of drain-bowl flange and does not restrict flow of water.
7. Install and secure preformed, 45-degree insulation cant strips at junctures with vertical surfaces or angle changes greater than 45 degrees.
8. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
9. Set each layer of insulation in continuous application of bead-applied insulation adhesive to adhere to substrate or layer below.

C. Cover Board Installation:
1. Install cover boards with long joints in continuous, straight lines, and with end joints staggered between rows.
2. Stagger joints from joints in insulation below at least of 6 inches in each direction.
3. Loosely butt cover boards together.
4. Set in continuous application of bead-applied insulation adhesive.

3.6 BASE PLY INSTALLATION

A. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature

B. Installation of Base Sheet:
1. Install base sheet according to roofing manufacturer’s written instructions, starting at low point of roofing system.
2. Extend roofing sheets over and terminate above cants.
3. Install base sheet in a shingle fashion.
4. Adhere to substrate in a uniform coating of cold-applied adhesive.
5. Install base sheet without wrinkles, rears, and free from air pockets.
6. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps complying with minimum laps and offsets recommended by the manufacturer.

### 3.7 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing sheet and cap sheet according to roofing manufacturer’s written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
   1. Unroll roofing sheets and allow them to relax for minimum time period required by manufacturer.
   2. Torch apply to substrate.

B. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
   1. Repair tears and voids in laps and lapped seams not completely sealed.
   2. Apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install roofing sheets so side and end laps shed water.

### 3.8 BASE FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer’s written instructions and as follows:
   1. Prime substrates with asphalt primer if required by roofing system manufacturer.
   3. Flashing-Sheet Application: Torch apply flashing sheet to substrate.

B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

D. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer’s written instructions.

E. Roof Drains: Set membrane base ply and fluid-applied flashing into the drain bowl. Cover fluid applied flashing with roofing membrane-sheet stripping, and extend a minimum of 4 inches
beyond edge of flashing onto field of roofing membrane. Apply roofing cap sheet and seal edge with elastomeric sealant. Clamp roofing base ply membrane fluid applied flashing into roof-drain clamping ring.
1. Install stripping according to roofing system manufacturer's written instructions.

3.9 FLUID APPLIED FLASHINGS

A. General: Install fluid-applied flashings and penetration flashings in accordance with manufacturer's written instructions. Prime substrates if required by roofing system manufacturer.

B. Mixing Preparation of Catalyzing Resin Products: Pour the desired quantity of resin into a clean container and using a spiral mixer or mixing paddle, stir the liquid for the time period specified by the resin manufacturer. Calculate the amount of catalyst powder needed using the manufacturer's guidelines and add the pre-measured catalyst to the resin component. Mix again for the time period specified by the resin manufacturer, ensuring that the product is free from swirls and bubbles. Ensure that air is not entrained into the product during the mixing process. To avoid aeration, do not use a spiral mixer unless the spiral section of the mixer can be fully contained in the liquid during the mixing process. Mix only enough product to ensure that it can be applied before expiration of resin pot life.

1. Preparation Paste and Primer Mixing/Application
   a. Primer Application: Apply primer resin using a roller or brush at the minimum rate specified by the roof membrane manufacturer over prepared substrates. Apply primer resin at the increased rate specified by the primer manufacturer. Increase application rates over absorbent substrates. Do not let resin pool or pond. Do not under-apply or over-apply primers as this may interfere with proper primer catalyzation. Make allowances for saturation of roller covers and application equipment.
   b. Paste Application: Allow the primer to set and apply catalyzed preparation paste using a trowel. Before application of resin over the catalyzed paste surface, the specified cleaner/solvent, wipe the surface of the paste using the specified cleaner/solvent and allow to dry. Treat the surface again if not followed up by resin application within 60 minutes.

C. Flashing Application:

1. Using masking tape, mask the perimeter of the area to receive the flashing system. Apply resin primer to substrates requiring additional preparation and allow primer to set.
2. Pre-cut fleece to ensure a proper fit at transitions and corners prior to membrane application.
3. Apply an even, generous base coat of flashing resin using a roller at the minimum rate specified by the resin manufacturer to prepared surfaces requiring flashing coverage. Work the fleece into the wet, catalyzed resin using a brush or roller to fully embed the fleece in the resin and remove trapped air. Lap fleece layers a minimum of 2 inches and apply an additional coat of catalyzed resin between layers of overlapping fleece. Again using a roller, apply an even top coat of catalyzed resin at the minimum rate specified by the resin manufacturer immediately following embedment of the fleece, ensuring full
saturation of the fleece. Ensure that the flashing resin is applied to extend beyond the fleece (maximum 0.25 inch). Remove the tape before the catalyzed resin sets. Make allowances for saturation of roller covers and application equipment.

4. Should work be interrupted for more than 12 hours or the surface of the catalyzed resin becomes dirty or contaminated by the elements, wipe the surface to be lapped with new flashing resin using the specified cleaner/solvent. Allow the surface to dry for a minimum 20 minutes and a maximum 60 minutes before continuing work.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Contractor may engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports.

B. Test cuts may be made to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
   1. Determine approximate quantities of components within roofing membrane according to ASTM D 3617.
   2. Examine test specimens for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
   3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
   1. Notify Owner’s representative 48 hours in advance of date and time of inspection.

D. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

E. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Owner’s representative.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Prefinished aluminum gutters and downspouts.
2. Prefinished sheet metal flashing and counterflashing.
3. Exposed metal trim.
4. Miscellaneous sheet metal flashing or accessories, including accessories required for concrete tile roofing.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
1. Section 05 50 00 - Metal Fabrications: For protection of dissimilar metals.
2. Section 07 32 16 - Concrete Roof Tiles: Provision of concrete tile roofing system.
4. Section 07 92 00 - Joint Sealants: Provision of joint sealants.
5. Section 08 63 00 - Metal-Framed Skylights: Provision of metal-framed skylights.
6. Section 09 90 00 - Painting and Coating: For field painting and touch-up painting of factory finished materials.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials
1. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. AWS - American Welding Society

C. SMACNA - Sheet Metal and Air Conditioning Contractors’ National Association

D. SSPC - The Society for Protective Coatings
1.3 SYSTEM DESCRIPTION

A. Performance Requirements
   1. Work of this Section shall physically protect concrete tile roofing, exterior plaster penetrations, wall and door openings, and joints to dissimilar materials and other items as indicated from damage that would permit water leakage to building interior.
   2. Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.
      a. Contractor is responsible for the design of sheet metal profiles not indicated on the Drawings and for determining the maximum lengths of segments.
   3. Flashing to be Installed: Provide complete flashing system for full extent of locations where flashing is shown to occur.

1.4 SUBMITTALS

A. Shop Drawings: Submit drawings showing material profile, jointing pattern, jointing details, intersections, fastening methods, flashings, terminations, and installation details prior to fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Materials
   1. Prefinished Aluminum: ASTM B209, Alloy 3003, 3004, 3105, or 5005, temper suitable for forming and structural performance required, but not less than H14, pre-finished as indicated.
      a. Gutters: Minimum 0.032-inch.
      c. Downspouts: Minimum 0.025-inch.
      d. Downspout Strainers: Wire ball in accordance with SMACNA Figure 1-24D.
   2. Prepainted, Prefinished, Galvanized Sheet Metal: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755.
      a. Copings, Edge Flashings, Counter, Pan, or Apron Flashings, and Sill Flashing: 24 gauge or minimum 0.0239-inch.
      b. Cleats: 20 gauge or minimum 0.0359-inch.
   3. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A653, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 20 gauge except as otherwise indicated.
   4. Lead Sheet: Copper-bearing, ASTM B749, Type L51121.

B. Miscellaneous Materials and Accessories
   1. Solder and Flux: For use with steel, provide 50 - 50 tin/lead solder, ASTM B32, with rosin flux. Re-melted or reworked solder will not be permitted.
   2. Fasteners: Same metal as flashing/sheet metal or other noncorrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
   3. Bituminous Coating: SSPC Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coat.
4. Reglets: Metal of type and profile indicated, compatible with flashing indicated, noncorrosive, as manufactured by Fry Reglet; Springlok, or equal.

5. Metal Accessories: Provide sheet metal clips, cleats, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size, and gauge required for performance.


7. Joint Sealant: As specified in Section 07 92 00.

C. Materials for Permanent Protection of Dissimilar Materials: As specified in Section 05 50 00.

2.2 FABRICATION

A. Shop Assembly
1. Design and fabricate work in accordance with SMACNA, unless otherwise indicated.
2. As far as practicable, form and fabricate sheet metal in shop. Where on-site fabrication is required, provide work equal to shop quality. Additionally, identify bulk materials from which items are field fabricated by manufacturer’s trademark printed or embossed at frequent intervals.
3. Reproduce accurately profiles and bends indicated.
4. Provide profiles with interactions that are sharp, even, and true; with plane surfaces free from buckles and waves; and seams that follow direction of water flow.
5. Reinforce correctly for strength and appearance.
6. Cut, fit, and drill sheet metal as required to accommodate related, adjacent, or adjoining work.
7. Exposed Edges of Sheet Metal: Fold, bend, or return exposed edges of sheet metal. Raw edges will not be permitted.
8. Form pieces in longest practical lengths.

B. Sheet Metal Joints
1. In general, provide lock joints; where impractical, lap, rivet, solder, or weld joints, or join as otherwise recommended by a system manufacturer.
2. Join joints and miters as recommended by a system manufacturer.
3. Where positive joining is required, weld in accordance with applicable AWS standards.
4. Turn lock joints on exposed surfaces in direction of flow.

C. Soldering
1. Neatly solder exposed surfaces.
2. Pre-tin edges minimum 1-1/2 inches both sides prior to soldering.

D. Expansion and Contraction of Sheet Metal Runs: Provide loose locking slip joint of maximum 8 feet from external and internal corners, maximum 10 feet length for valley flashing and other skyward-facing pieces, maximum 24 feet length of straight runs, unless manufacturer recommends more frequent interval, and 1 at center of runs less than 20 feet, but more than 8 feet, unless specified otherwise following herein.
E. Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96-inch long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.

F. Downspouts: Fabricate downspouts, as indicated on the Drawings, complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Provide custom aluminum downspout bracket as manufactured by Copper Shoppe Solutions, “TORRES”, or equal.

G. Roof Penetration Flashing: Fabricate from lead, 4 lb./sq.ft., hard tempered.

H. Provide the following items of materials and minimum gauges as indicated:
   1. Cleats: Formed of same metal as that being anchored, with size, shape, and quantity as required to secure flashing and sheet metal work in place.
   2. Base Flashing, Counterflashing, and Roof Penetration Flashing
      a. Formed with 3/4-inch locked and soldered seams, assembled into units not longer than 16 feet.
      b. Join units with 3/4-inch wide loose locked seams filled with soft grade butyl base compound, before units are assembled.
      c. Mitre corners and joints by riveted or locked and soldered joints.
   3. Counterflashing at Reglets: Form counterflashing at walls to extend into installed, prefilled metal reglets. Form metal in a manner which will provide spring action against the roof flashings.

I. Finishing: For pieces requiring welding or soldering, apply finish after fabrication.
   1. Prefinished Aluminum: As indicated.
   2. Galvanized Sheet Metal: G90, conforming to ASTM A653 and ASTM A924.
      a. After Fabrication: Touch-up abraded surfaces in accordance with Section 09 90 00.
   3. Prefinished Sheet Metal: Where indicated, sheet metal shall be coil coated with organic coating as manufactured by Kynar 500 or Hylar 5000.
      a. Color: As selected by the Architect.
   4. Field Finish Painting Where Needed: As specified in Section 09 90 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conform with SMACNA procedures and methods of installation.

B. Where installation requires fabrication at the Project site, conform to applicable requirements of Article titled “Fabrication” in this Section.

C. Coordinate flashing finishes with waterproof products that will be in contact with flashing. Provide bonderized, acid wash, grip-lock, etc., flashings as required by adjoining product manufacturers. Flashings requiring a chemical wash will be prepared at site and prior to installation.

D. Install standard catalog products in accordance with manufacturer’s instructions, unless otherwise indicated.
E. Install work watertight; ensure that items are installed in true and accurate alignment with other items and related work, that joints are accurately fitted, that corners are reinforced and that exposed surfaces are free of dents.

F. Apply flashing compound at slip joints or wherever metal-to-metal contact occurs and movement may be anticipated to occur.

G. Gutters: Join sections with riveted and soldered or lapped joints sealed with sealant. Provide for thermal expansion. Slope to downspouts. Provide end closures and seal watertight with sealant.
   1. Install felt underlayment layer in built-in gutter trough and extend to drip edge at eaves and under felt underlayment on roof sheathing. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails. Install slip sheet over felt underlayment.
   2. Anchor and loosely lock back edge of gutter to continuous cleat.
   3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
   4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

H. Downspouts: Join sections with 1-1/2 inch telescoping joints.
   1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
   2. Provide elbows at base of downspout to direct water away from building.

I. Flashings
   1. Fasten sheet metal runs to underlaying material by nailing through slotted holes in flange at 3 inches on center, unless otherwise indicated or required by manufacturer.
   2. Provide waterproof washers wherever fasteners penetrate flashings.
   3. Flashings at horizontal and vertical intersections to shop fabricated heels with full solder seams. Flashings will lap onto all intersecting planes 4-inch or to a minimum beyond 4-inch to allow for the weatherboard lap of flashings with surround building moisture resistant/proof sheathing.

J. Cleaning Metal Surface Primer Ready: Cleaning products shall not contaminate adjacent materials. Factory clean where possible. Notify paint applicator when paint ready so as not to allow any oxidization to occur.

3.2 ADJUSTING

A. Replace damaged material with new.

END OF SECTION
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SECTION 07 62 01
ROOF UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Underlayment and flashings for concrete tile roofing at new building.

B. Related Requirements:
   1. Section 061053 - Miscellaneous Rough Carpentry; for wood nailers, curbs, and blocking.
   2. Section 072726 - Fluid-Applied Membrane Air/Water Barriers.
   3. Section 073216 - Concrete roof tiles
   4. Section 076200 - Sheet metal Flashing and Trim
   5. Section 079201 - Exterior Joint Sealants; for sealant installation.

1.2 COORDINATION

A. Coordinate underlayment and flashing layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate underlayment and flashing installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: Include underlayment in shop drawings for sheet metal flashing and trim.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.
B. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who install underlayment and flashings similar to that required for this Project and whose products have a record of successful in-service performance.

B. Mockups: Build mockups to set quality standards for fabrication and installation.
   1. Build mockup of typical roof edge, counterflashing, mechanical curb, and coping approximately 10 feet long, including supporting construction cleats, seams, attachments, sheet metal, and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store underlayment and flashings in contact with other materials that might cause staining or other damage.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Underlayment and flashing assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed underlayment and flashing shall not un-adhere or delaminate and shall remain watertight.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, over stressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 UNDERLAYMENT / FLASHING MATERIAL

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high temperatures beneath roofing. Provide primer according to written recommendations of underlayment manufacturer.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.
3. Provide Ultra from GCP Applied Technologies, or approved equal.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of sealants, and other miscellaneous items as required for complete installation and as recommended by manufacturer of concrete tile roofing.

B. Sealant Tape Above Underlayment: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant intended to adhere to low surface energy materials, such as polyethylene and polypropylene facers. Basis of design, Dow sil 758.

D. Butyl Sealant Above Underlayment: Non-skimming, non-curing, high temperature butyl sealant to be used in compression between metal sheet sections (e.g., at laps and splices).
   1. TremPro JS-773, manufactured by Tremco

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify substrate is sloped a minimum of 1/2 inch per foot.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment:
   1. Prime substrate if recommended by underlayment manufacturer.
   2. Install self-adhering sheet underlayment, wrinkle free.
   3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
   4. Apply in shingle fashion to shed water.
5. End laps of not less than 6 inches staggered 24 inches between courses.
6. Overlap side edges not less than 3-1/2 inches.
7. Roll laps and edges with roller.
8. Cover underlayment within 14 days.

B. At contractor’s option, apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing or concrete roof tiles.

3.3 FLASHING INSTALLATION

A. General: Install flashing to comply with performance requirements. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Install flashing starter courses as needed to integrate with Work below. Lap over sheet metal flashing a minimum of 4 inches, and cover all fastener penetrations.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and sheet metal flashing. Seal leading edges of underlayment/flashing with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.4 CLEANING AND PROTECTION

A. Clean off excess sealants and debris.

B. Replace underlayment and flashings that have been damaged or that have deteriorated beyond successful repair.

C. Ensure underlayment and flashings will be permanently protected from UV exposure by roofing or sheet metal above.

END OF SECTION
SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Penetrations in fire resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations and joints in smoke barriers.
   4. Joints in or between fire resistance-rated constructions.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 07 21 01 - Building Insulation: Provision of building insulation.
   2. Section 07 92 00 - Joint Sealants: Provision of joint sealers and caulks.
   3. Division 23 - Heating, Ventilating, and Air Conditioning (HVAC): For mechanical work requiring firestopping.
   4. Division 26 - Electrical: For electrical work requiring firestopping.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

B. CALGreen - California Green Building Standards, 2016 Edition

C. CBC - California Building Code, 2016 Edition

D. FM - Factory Mutual
   1. P7825 - Approval Guide.

E. IFC - International Firestop Council

F. NFPA - National Fire Protection Association
   1. 70 - National Electrical Code.

G. UL - Underwriters Laboratories, Inc.
   1. 1479 - Standard for Fire Tests of Through-Penetration Firestops.
   2. BMD - Building Materials Directory.
1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Through penetration firestopping systems or designs shall be the types tested in accordance with ASTM E814 or UL 1479 and listed by UL FRD or approved by FM P7825.

B. Sealants used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.1.

1.4 SUBMITTALS

A. Product Data
   1. Manufacturer’s specifications and installation instructions for all materials and prefabricated devices, providing descriptions sufficient for identification at the jobsite.
   2. Instruction details shall reflect actual job conditions.
   3. Where available, include aging data for intumescent products.
   4. Where available, include L rating indicating tested air leakage for products used in through-penetration systems.

B. Shop Drawings
   1. Manufacturer’s UL-approved assembly drawings are acceptable as shop drawings if they reflect actual job conditions.
   2. For job conditions where no clearly defined UL-approved assembly exists, provide an engineering judgment from manufacturer. Where requested by Architect, submit drawings showing each condition to document proposed systems, materials, anchorage, methods of installation, and type of construction assembly being penetrated.
      a. Engineering judgments shall follow requirements set forth by the IFC.
      b. Proposed system shall be acceptable to local governing authorities.

C. Quality Control
   1. Manufacturer’s letter of certification, or certified laboratory test report, stating that materials and combination of materials meet requirements specified in ASTM E814 and are so classified in UL’s BMD.
   2. UL Certificates of Compliance.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Conform to CBC for fire resistance ratings and surface burning characteristics.
   2. Firestopping installation shall meet requirements of UL 1479 or ASTM E814 and applicable code requirements of authorities having jurisdiction based on ASTM E119.
   3. Firestopping materials shall be listed and approved by local building department for intended use.
   4. Materials shall meet requirements of NFPA 101 and NFPA 70.

B. Installer Qualifications: A Firestop Specialty Contractor (FSC) experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.
1. Qualifications include having the necessary experience, staff, and training to install manufacturer’s products per specified requirements. Manufacturer’s willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

2. Contractor shall be responsible for verifying and submitting documentation verifying conformance with the above installer qualifications whether installer is under direct contract or a sub-subcontractor. Documentation shall be submitted for each installer working on the Project.

C. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through penetration firestop systems are installed per specified requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: 3M; Bio Fireshield; Hilti; General Electric; Specified Technologies Inc., or equal.

2.2 MATERIALS

A. Provide asbestos free firestopping material capable of maintaining an effective barrier against flame, gases, and temperature. Provide noncombustible firestopping that is nontoxic to human beings during installation or during fire conditions. Devices and equipment for firestopping service shall be UL FRD listed or FM P7825 approved for use with applicable construction, and penetrating items.

B. Fire Hazard Classification: Material shall have a flame spread of 25 or less, a smoke developed rating of 50 or less when tested in accordance with UL 723 or UL listed and accepted.

C. Firestopping Rating: Firestopping materials shall be UL FRD listed or FM-7825 approved for “F” and “T” ratings at least equal to fire rating of fire wall or floor in which penetrated openings are to be protected.


E. Firesafing: SAFB mineral wool as manufactured by USG, or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to application, remove from surfaces dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting or required fire resistance of firestopping materials. Prepare surface as recommended by manufacturer.
3.2 APPLICATION

A. General
   1. Provide firestopping for conditions specified whether or not firestopping is indicated, and, if indicated, whether such material is designated as insulation, safing, or sealant.
   2. Do not install insulation specified in Section 07 21 01 in place of firestopping materials specified in this Section.

B. Install firestopping in accordance with UL FRD systems or FM P7825 designs, and as recommended by manufacturer, printed instructions of the UL BMD, manufacturer’s instructions, or architectural detail as indicated on the Systems and Applications Schedule.

C. Apply firestopping material in sufficient thickness to achieve rating to uniform density and texture.

D. Install material at the following locations:
   1. Around duct, cable, conduit, piping, and their supports that penetrate fire rated above grade floor slabs, interior partitions and exterior walls.
   2. Around openings and penetrations through fire rated ceiling assemblies.
   3. Around penetration of vertical fire rated service shafts.
   4. Around openings and penetrations through fire rated enclosures.
   5. Slip joints at construction of rated walls to floor ceilings.
   6. At other locations as indicated and/or required by building Code.

E. Install firestop with sufficient pressure to properly fill and seal openings to ensure effective smoke seal.

F. Insulated Pipes and Ducts: Cut and remove thermal insulation where pipes and ducts pass through firestoppings. Replace thermal insulation with material having equal thermal insulation characteristics and equal firestopping characteristics.

3.3 FIELD QUALITY CONTROL

A. Immediately notify the Architect if the specified firestopping systems cannot meet the requirements of the Specification.

B. All areas of work must be accessible until inspected by the Architect and the District’s applicable fire protection representative. Correct unacceptable firestops and provide additional inspection to verify compliance with this Specification at no additional cost.

END OF SECTION
SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Joint sealants and backing systems for the following locations:
   1. Exterior and interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
      a. Perimeter joints of exterior and interior openings where indicated.
      b. Other joints as indicated.
   2. Interior joints in horizontal traffic surfaces as indicated below:
      a. Control and expansion joints in cast-in-place concrete slabs.
      b. Other joints as indicated.
   3. Acoustical sealant for concealed joints.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 05 45 00 - Metal Support Assemblies: Provision of metal support assemblies.
   2. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of sheet metal flashing and trim.
   3. Section 07 84 00 - Firestopping: Provision of firestopping.
   6. Section 08 63 00 - Metal-Framed Skylights: Provision of metal-framed skylights.
   7. Section 08 90 00 - Louvers and Vents: Provision of louvers and vents.
   8. Section 09 24 00 - Cement Plastering: Provision of exterior portland cement plasterwork.
   9. Section 09 29 00 - Gypsum Board: Provision of gypsum board.
   10. Section 12 36 61.16 - Solid Surfacing Countertops: Provision of solid surfacing countertops.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials
B. CALGreen - California Green Building Standards, 2016 Edition

C. CFR - Code of Federal Regulations

D. EPA - Environmental Protection Agency

E. FS - Federal Specifications
1. TT-S-001657 - Interim Federal Specification, Sealing Compound—Single Component, Butyl Rubber Based, Solvent Release Type (For Buildings and Other Types of Construction).
2. TT-S-1543B - Sealing Compound, Silicone Rubber Base.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide joint sealers that have been manufactured to establish and maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Sealants used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.1.

1.4 SUBMITTALS

A. Product Data: Submit product data from manufacturers for each joint sealant product required.

B. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
1. Submit samples of all standard colors of sealant which is not paintable.

1.5 QUALITY ASSURANCE

A. Field Adhesion Testing: Before installing sealants, field test their adhesion to project joint substrates with the sealant manufacturer’s technical representative present. Perform 10 tests in the first 1,000 feet of each sealant type and substrate, followed by 1 test every 1,000 feet thereafter. Include the following:
1. Locate test joints where indicated on project or, if not indicated, as direct by the Architect.
   a. Conduct field tests for each application and for each kind of sealant and joint substrate indicated.
2. Notify the Architect 7 days in advance of dates and times when test joints will be erected.
3. Arrange for tests to take place with joint sealant manufacturer’s technical representative present.
   a. Test joint sealants by hand-pull method described as follows:
      1) Install joint sealants in 60-inch long joints using same materials and methods for joint preparation and joint sealant installation required for the completed work. Allow sealants to cure fully before testing.
      2) Make knife cuts from one side of joint to the other, followed by 2 cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
      3) Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
      4) For joints with dissimilar substrates, verify adhesion to each substrate separately. Do this by extending cut along one side, verifying adhesion to the opposite side, and then repeating this procedure for opposite side.
   b. Refer to ASTM C1521 for Tail Procedure.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field Adhesion Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 WARRANTY

A. Special Manufacturer’s Warranty: Manufacturer’s standard form in which silicone sealant manufacturer agrees to furnish silicone joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General Requirements
   1. Provide joint sealers compatible with one another and with substrates.
   2. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Sealants: 250 g/L.
      b. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Manufacturer’s standard color range shall permit matching sealants to color of contacting surfaces and future ability to paint.
B. Sealants and Caulks

1. Type A - One Part Neutral Cure Silicone Sealant
   a. Use at non-moving joints in exterior walls and storefront perimeter.
   b. ASTM C920, non-sag, one part, low- or medium-modulus, elastomeric sealant.
   c. Color: As selected by the Architect.

2. Type B - Polyurethane Sealant, Two Component
   a. Use at horizontal trafficable joints.
   b. ASTM C920, Type M; Grade P; Class 25; Use T having minimum ASTM D2240 Shore A hardness of 30 plus or minus 5.
   c. Color: As selected by the Architect.

3. Type C - Silicone Sealant, Single Component
   a. Use for joints adjacent to tile.
   b. FS TT-S-1543B, mildew resistant, chemical curing, non-sagging, non-staining, nonbleeding.
   c. Color: As selected by the Architect.

4. Type D - Acrylic Emulsion Sealant
   a. For interior use only.
   b. ASTM C834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.
   c. Color: As selected by the Architect.

5. Type E - Acoustical Sealant
   a. For interior use only.
   b. Non-hardening, non-skinning, for use in conjunction with gypsum board.

6. Type F - Sheet Metal Lap Sealant
   a. Use at lapped sheet metal joints.
   b. 1-part non-skinning, non-hardening butyl conforming to FS TT-S-001657, Type 1.

7. Type G - Detail Joint and Bonding Sealant
   a. Use where sealant must adhere to polyethylene face of self-adhered flashings.
   b. ASTM C920, single component, neutral curing silicone, Grade NS, Class 25, compatible with adjacent materials. Provide products recommended by air barrier and sealant manufacturers for application.
   c. Product: As manufactured by Dow-Corning, “758”, or equal.
2.2 ACCESSORIES

A. Primer: Non-staining type recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Bi-cellular, ASTM C1330, Type B.

D. Backer Rod at Acoustical Sealant: Flexible closed cell, neoprene rod or polyethylene foam suitable for use as a backer to the acoustic sealant. Width of backer rod shall be a minimum of 30 percent greater and a maximum of 50 percent greater than the joint width.

E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer’s printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Installation of Sealant Joint Backings: Install sealant joint backings to comply with the following requirements:
   1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers.
      b. Do not stretch, twist, puncture, or tear joint fillers.
      c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
   2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints for 2 opposing side adhesion only.

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer’s directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer’s recommendations.

3.2 SCHEDULE

A. Type A, Non-Sag

1. Exterior and interior control and expansion joints in vertical surfaces of cast-in-place concrete.
2. Between metal and concrete.
3. Interior and exterior perimeter joints between cast-in-place concrete and frames of doors and windows.
4. Control and expansion joints in exterior soffits and overhead surfaces.
5. All other exterior joints not specified.

B. Type B: Exterior control, expansion, and isolation joints in cast-in-place concrete slabs.

C. Type C: Not Used.

D. Type D: All other interior joints not indicated otherwise.

E. Type E: Concealed acoustical conditions.

F. Type F: Lap joints and other moving joints in sheet metal.

G. Type G: At self-adhered flashings and air barriers.

END OF SECTION
SECTION 08 06 71
DOOR HARDWARE SETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding Doors.
   3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical and access control door hardware.
   3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
   4. Automatic operators.
   5. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Division 08 Section “Hollow Metal Doors and Frames”.
   2. Division 08 Sections “Flush and Clad Wood Doors”.
   3. Division 08 Section “Door Hardware”.
   4. Division 08 Section “Automatic Door Operators”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum [5] years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum [3] years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum [5] years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in the Related Sections from a single source, qualified supplier unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the applicable model building code.

F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the “Keying Conference”.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.
PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Products listed in the Door Hardware Sets must meet the requirements described in the specification sections noted.

1. Section 08 41 26 – All Glass Entrances.
2. Section 08 71 00 – Door Hardware.
3. Section 08 74 13 – Card Key Access Control Hardware.
4. Section 28 13 00 – Access Control.
5. Section 28 13 10 – Multi-Family Access Control.

D. Materials to be furnished in accordance to Premier/ASSA ABLOY GPO Contract #PP-FA-663.

E. Manufacturer’s Abbreviations:

1. MK - McKinney
2. RO - Rockwood
3. VD - Von Duprin
4. RU - Corbin Russwin
5. SA - SARGENT
6. RF - Rixson
7. NO - Norton
8. PE - Pemko
9. SU - Securitron
10. HD - HID

Hardware Sets

Set: 1.0

Doors: 01A, 20A
2 Continuous Hinge  MCK-12HD PT  CL  MK 087100
1 Mullion  4954-XP  SP28  VD 087100
1 Rim Exit Device  QEL RX AX 98EO  US32D  VD 087100
1 Retrofit Kit  IN220-231 BIPS MW EK1P  US32D  SA 281300
1 Rim Exit Device  RX AX 98EO  US32D  VD 087100
1 Cylinder Housing  CR1070-114- MK  626  RU 087100
1 Cylinder Housing  CR3070-178- MK  626  RU 087100
2 Interchangeable Core  CR8000-  626  RU 087100
1 Surface Closer  PR7500  689  NO 087100
1 Automatic Opener  6330/10 as required  689  NO 087113 ⚡
2 Door Stop  463-RKW  US32D  RO 087100
1 Threshold  ___A FHSL14 as detailed  PE 087100
1 Gasketing  by door mfg.
2 Sweep  315CN  PE 087100
2 Electric Power Transfer  EL-CEPT  SU 087100 ⚡
1 ElectroLynx Harness  QC-C1500P  MK 087100 ⚡
1 ElectroLynx Harness  QC-C306P  MK 087100 ⚡
1 ElectroLynx Harness Frame  PoE-C____PRJ  MK 087100 ⚡
1 ElectroLynx Harness Door  PoE-C____PRJ  MK 087100 ⚡
2 Push Plate  639  NO 087100 ⚡
1 Keyswitch  MKAN  SU 087100 ⚡
1 Switch Post  500  NO 087100 ⚡

Set: 2.0

Doors: 164A, 164C

1 Continuous Hinge  MCK-12HD PT  CL  MK 087100
1 Retrofit Kit  IN220-231 BIPS MW EK1P  US26D  SA 281300
1 Rim Exit Device  RX AX 98EO  US32D  VD 087100
1 Cylinder Housing  CR1070-114- MK  626  RU 087100
1 Interchangeable Core  CR8000-  626  RU 087100
1 Concealed Closer  91N  626  RF 087100
1 Door Stop  463-RKW  US32D  RO 087100
1 Threshold  ___A FHSL14 as detailed  PE 087100
1 Gasketing  by door mfg.
1 Sweep  315CN  PE 087100
1 Electric Power Transfer  EL-CEPT  SU 087100 ⚡

Contra Costa Community College District
Diablo Valley College
D-4002 SRC Increment 2
1 ElectroLynx Harness Frame  PoE-C___PRJ  MK 087100 ⚡
1 ElectroLynx Harness Door  PoE-C___PRJ  MK 087100 ⚡

Set: 3.0
Doors: 02A, 03A, 04A, 05A, 06A, 09A, 09B, 102A

3 Hinge (heavy weight)  T4A3786 4.5 x 4.5  US26D  MK 087100
1 Entrance Lock w/Secure Indicator  ML2053 PSA M19N C6  626  RU 087100
1 Door Stop  441CU/409 as required  US26D  RO 087100
1 Gasketing  S773GR  PE 087100
1 Door Bottom  STC411APK36  PE 087100

Set: 4.0
Doors: 232A

3 Hinge  TA2714 4.5 x 4.5  US26D  MK 087100
1 Storeroom Lock  ML2057 PSA C6  626  RU 087100
1 Surf Overhead Stop  55-X36  652  RF 087100
1 Kick Plate  K1050 10X2LDW BEV CSK  US32D  RO 087100
1 Gasketing  S44GR  PE 087100
1 Door Bottom (Discontinued)  PDB411AE  PE 087100

Set: 5.0
Doors: 107E, 108A, 10A, 11A, 14A

3 Hinge  TA2714 4.5 x 4.5  US26D  MK 087100
1 Storeroom Lock  ML2057 PSA C6  626  RU 087100
1 Door Stop  441CU/409 as required  US26D  RO 087100

Set: 6.0
Doors: 13A

2 Hinge (heavy weight)  T4A3786 4.5 x 4.5  US26D  MK 087100
1 Hinge (heavy weight)  T4A3786 PoE 4-1/2" x 4-1/2"  US26D  MK 087100 ⚡
1 Access Control Mort Lock  IN220-ML20134 MW PSA BIPS C6  626  RU 281300 ⚡
1 Surface Closer  7500  689  NO 087100
1 Kick Plate  K1050 10X2LDW BEV CSK  US32D  RO 087100
1 Door Stop  441CU/409 as required  US26D  RO 087100
<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Model/Size</th>
<th>Color</th>
<th>Notes</th>
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<tr>
<td>1</td>
<td>ElectroLynx Harness Frame</td>
<td>PoE-C____PRJ</td>
<td>MK 087100</td>
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<tr>
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<td>ElectroLynx Harness Door</td>
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<tr>
<td>1</td>
<td>Power Supply</td>
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<td>provided by access control.</td>
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**Set: 7.0**

Doors: 20B

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<tr>
<td>1</td>
<td>Continuous Hinge</td>
<td>MCK-12HD</td>
<td>CL</td>
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<td>1</td>
<td>Rim Exit Device</td>
<td>AX 98L-NL ALK 996L-NL</td>
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<tr>
<td>1</td>
<td>Cylinder Housing</td>
<td>CR1070-114- MK</td>
<td>626</td>
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<tr>
<td>1</td>
<td>Cylinder Housing</td>
<td>CR3070-178- MK</td>
<td>626</td>
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<td>2</td>
<td>Interchangeable Core</td>
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<tr>
<td>1</td>
<td>Surface Closer</td>
<td>PR7500</td>
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<td>___A FHS1.14 as detailed</td>
<td>PE</td>
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<td>Sweep</td>
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**Set: 8.0**


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<td>T4A3386 PoE 4-1/2&quot; x 4-1/2&quot;</td>
<td>US32D</td>
<td>MK 087100</td>
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<td>1</td>
<td>Retrofit Kit</td>
<td>IN220-231 BIPS MW EK1P</td>
<td>US32D</td>
<td>SA 281300</td>
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<td>RU 087100</td>
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<tr>
<td>1</td>
<td>Interchangeable Core</td>
<td>CR8000-</td>
<td>626</td>
<td>RU 087100</td>
</tr>
<tr>
<td>1</td>
<td>ElectroLynx Harness Frame</td>
<td>PoE-C____PRJ</td>
<td>MK 087100</td>
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<tr>
<td>1</td>
<td>ElectroLynx Harness Door</td>
<td>PoE-C____PRJ</td>
<td>MK 087100</td>
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Notes: Field verify correct hinge required.

**Set: 9.0**

Doors: 168A, 229A, 229B, 231BA

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<tr>
<td>1</td>
<td>Balance of Hardware existing</td>
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Contra Costa Community College District
 Diablo Valley College
 D-4002 SRC Increment 2
Set: 10.0

Doors: 103A

2 Hinge (heavy weight)  
   T4A3786 4.5 x 4.5  
   US26D  MK 087100

1 Hinge (heavy weight)  
   T4A3786 PoE 4-1/2" x 4-1/2"  
   US26D  MK 087100

1 Access Control Mort Lock  
   IN220-ML20134 MW PSA BIPS C6  626  RU 281300

1 Surface Closer  
   7500  
   689  NO 087100

1 Kick Plate  
   K1050 10X2LDW BEV CSK  
   US32D  RO 087100

1 Door Stop  
   441CU/409 as required  
   US26D  RO 087100

1 Gasketing  
   S44GR  
   PE 087100

1 ElectroLynx Harness Frame  
   PoE-C____PRJ  
   MK 087100

1 ElectroLynx Harness Door  
   PoE-C____PRJ  
   MK 087100

Set: 11.0

Doors: 148A

1 Continuous Hinge  
   MCK-12HD PT  
   CL  
   MK 087100

1 Access Control Mort Lock  
   IN220-ML20134 MW PSA BIPS C6  626  RU 281300

1 Concealed Closer  
   91N  
   626  RF 087100

1 Kick Plate  
   K1050 10X2LDW BEV CSK  
   US32D  RO 087100

1 Door Stop  
   463-RKW  
   US32D  RO 087100

1 Threshold  
   A FHSL14 as detailed  
   PE 087100

1 Gasketing  
   S773GR  
   PE 087100

1 Sweep  
   315CN  
   PE 087100

1 Electric Power Transfer  
   EL-CEPT  
   SU 087100

1 ElectroLynx Harness Frame  
   PoE-C____PRJ  
   MK 087100

1 ElectroLynx Harness Door  
   PoE-C____PRJ  
   MK 087100

1 Power Supply  
   provided by access control.

Set: 12.0

Doors: 105A, 162B, 164B, 180A, 189A, 233A

1 Access Control Mort Lock  
   IN120-ML20134 W PSA BIPS C6  626  RU 281300

1 Balance of Hardware existing

Set: 13.0

Doors: 165A
### Set: 14.0

Doors: 181B

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<td>ML2057 PSA C6</td>
<td>626</td>
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Set: 14.0

Doors: 181B

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<td>1 Exit Device Trim</td>
<td>990NL</td>
<td>US26D</td>
<td>VD 087100</td>
</tr>
<tr>
<td>1 Cylinder Housing</td>
<td>CR1070-114- MK</td>
<td>626</td>
<td>RU 087100</td>
</tr>
<tr>
<td>1 Cylinder Housing</td>
<td>CR3070-178- MK</td>
<td>626</td>
<td>RU 087100</td>
</tr>
<tr>
<td>2 Interchangeable Core</td>
<td>CR8000-</td>
<td>626</td>
<td>RU 087100</td>
</tr>
<tr>
<td>1 Alarm</td>
<td>98 ALK</td>
<td>US32D</td>
<td>VD 087100</td>
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Set: 15.0

Doors: 107B

<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Specs</th>
<th>Finish</th>
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<tbody>
<tr>
<td>1 Balance of Hardware existing</td>
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Notes: Local alarm by security.

Set: 16.0

Doors: 181BA

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<tr>
<th>Item</th>
<th>Model/Specs</th>
<th>Finish</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>3 Hinge (heavy weight)</td>
<td>T4A3786 4.5 x 4.5</td>
<td>US26D</td>
<td>MK 087100</td>
</tr>
<tr>
<td>1 Storeroom Lock</td>
<td>ML2057 PSA C6</td>
<td>626</td>
<td>RU 087100</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>K1050 10X2LDW BEV CSK</td>
<td>US32D</td>
<td>RO 087100</td>
</tr>
<tr>
<td>1 Door Stop</td>
<td>441CU/409 as required</td>
<td>US26D</td>
<td>RO 087100</td>
</tr>
<tr>
<td>1 Gasketeting</td>
<td>S773GR</td>
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Set: 17.0

Doors: 229C

<table>
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<th>Finish</th>
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<tr>
<td>2 Hinge (heavy weight)</td>
<td>T4A3786 4.5 x 4.5</td>
<td>US26D</td>
<td>MK 087100</td>
</tr>
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<td>1 Hinge (heavy weight)</td>
<td>T4A3786 PoE 4-1/2&quot; x 4-1/2&quot;</td>
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<td>MK 087100</td>
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<tr>
<td>1 Access Control Mort Lock</td>
<td>IN220-ML20134 MW PSA BIPS C6</td>
<td>626</td>
<td>RU 281300</td>
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<tr>
<td>1 Surface Closer</td>
<td>7500</td>
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<td>NO 087100</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>K1050 10X2LDW BEV CSK</td>
<td>US32D</td>
<td>RO 087100</td>
</tr>
<tr>
<td>1 Door Stop</td>
<td>441CU/409 as required</td>
<td>US26D</td>
<td>RO 087100</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>___ A FHS L14 as detailed</td>
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</tr>
<tr>
<td>1 Gasketeting</td>
<td>S773GR</td>
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Door Hardware
5/30/2019
<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Code</th>
<th>Quantity</th>
<th>Description</th>
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<tbody>
<tr>
<td>Door Bottom</td>
<td>222APK</td>
<td>1</td>
<td>PoE-C____PRJ</td>
</tr>
<tr>
<td>ElectroLynx Harness Frame</td>
<td></td>
<td>1</td>
<td>PoE-C____PRJ</td>
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<tr>
<td>Power Supply</td>
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**Set: 18.0**

Doors: 230B

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<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rim Exit Device</td>
<td>AX 98EO ALK</td>
<td>1</td>
<td>US32D VD 087100</td>
</tr>
<tr>
<td>Cylinder Housing</td>
<td>CR1070-114-MK</td>
<td>1</td>
<td>626 RU 087100</td>
</tr>
<tr>
<td>Interchangeable Core</td>
<td>CR8000</td>
<td>1</td>
<td>626 RU 087100</td>
</tr>
<tr>
<td>Threshold</td>
<td></td>
<td>1</td>
<td>__A FHS14 as detailed</td>
</tr>
<tr>
<td>Gasketing</td>
<td></td>
<td>1</td>
<td>S773GR</td>
</tr>
<tr>
<td>Door Bottom (Discontinued)</td>
<td></td>
<td>1</td>
<td>PDB411AE</td>
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<td>Balance of Hardware existing</td>
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**Set: 19.0**

Doors: 228A

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<th>Quantity</th>
<th>Description</th>
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<tbody>
<tr>
<td>Continuous Hinge</td>
<td>MCK-12HD PT</td>
<td>2</td>
<td>CL MK 087100</td>
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<td>Mullion</td>
<td>4954-XP</td>
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<td>SP28 VD 087100</td>
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<td>Retrofit Kit</td>
<td>IN220-231 BIPS MW EK1P</td>
<td>1</td>
<td>US26D SA 281300</td>
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<tr>
<td>Rim Exit Device</td>
<td>RX AX 98EO</td>
<td>2</td>
<td>US32D VD 087100</td>
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<tr>
<td>Cylinder Housing</td>
<td>CR3070-178-MK</td>
<td>1</td>
<td>626 RU 087100</td>
</tr>
<tr>
<td>Interchangeable Core</td>
<td>CR8000</td>
<td>1</td>
<td>626 RU 087100</td>
</tr>
<tr>
<td>Concealed Closer</td>
<td>91N</td>
<td>2</td>
<td>626 RF 087100</td>
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<tr>
<td>Door Stop</td>
<td>463-RKW</td>
<td>2</td>
<td>US32D RO 087100</td>
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<tr>
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<td>1</td>
<td>__A FHS14 as detailed</td>
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<tr>
<td>Gasketing</td>
<td>by door mfg.</td>
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<tr>
<td>Electric Power Transfer</td>
<td>EL-CEPT</td>
<td>2</td>
<td>SU 087100</td>
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<td>ElectroLynx Harness</td>
<td>QC-C1500P</td>
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<td>ElectroLynx Harness Frame</td>
<td>PoE-C____PRJ</td>
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<td>MK 087100</td>
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<tr>
<td>ElectroLynx Harness Door</td>
<td>PoE-C____PRJ</td>
<td>1</td>
<td>MK 087100</td>
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<tr>
<td>Power Supply</td>
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**Set: 20.0**

Doors: 103AA
<table>
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<tr>
<th>Item</th>
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<th>Hardware</th>
<th>Model/Details</th>
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</thead>
<tbody>
<tr>
<td>6 Hinge</td>
<td>TA2714 4.5 x 4.5</td>
<td>US26D</td>
<td>MK</td>
<td>087100</td>
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<tr>
<td>1 Flush Bolt</td>
<td>2805</td>
<td>US26D</td>
<td>RO</td>
<td>087100</td>
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<tr>
<td>1 Storeroom Lock</td>
<td>ML2057 PSA C6</td>
<td>626</td>
<td>RU</td>
<td>087100</td>
</tr>
<tr>
<td>2 Door Stop</td>
<td>441CU/409 as required</td>
<td>US26D</td>
<td>RO</td>
<td>087100</td>
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<tr>
<td>1 Astragal</td>
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**Set: 21.0**

Doors: 107C

<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Details</th>
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<th>Model/Details</th>
<th>Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Continuous Hinge</td>
<td>MCK-12HD</td>
<td>CL</td>
<td>MK</td>
<td>087100</td>
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<tr>
<td>2 Concealed Vert Rod Exit</td>
<td>3547A-L 17 LBR 360L</td>
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<td>VD</td>
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<td>2 Cylinder Housing</td>
<td>CR1070-114- MK</td>
<td>626</td>
<td>RU</td>
<td>087100</td>
</tr>
<tr>
<td>2 Interchangeable Core</td>
<td>CR8000-</td>
<td>626</td>
<td>RU</td>
<td>087100</td>
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<tr>
<td>2 Concealed Closer</td>
<td>91N</td>
<td>626</td>
<td>RF</td>
<td>087100</td>
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<tr>
<td>2 Door Stop &amp; Holder</td>
<td>491-RKW</td>
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**Set: 22.0**

Doors: 181A

<table>
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<tr>
<th>Item</th>
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<th>Hardware</th>
<th>Model/Details</th>
<th>Hardware</th>
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</thead>
<tbody>
<tr>
<td>1 Continuous Hinge</td>
<td>MCK-12HD PT</td>
<td>CL</td>
<td>MK</td>
<td>087100</td>
</tr>
<tr>
<td>1 Rim Exit Device</td>
<td>QEL RX AX 98EO</td>
<td>US32D</td>
<td>VD</td>
<td>087100</td>
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<tr>
<td>1 Retrofit Kit</td>
<td>IN220-231 BIPS MW EK1P</td>
<td>US26D</td>
<td>SA</td>
<td>281300</td>
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<tr>
<td>1 Cylinder Housing</td>
<td>CR1070-114- MK</td>
<td>626</td>
<td>RU</td>
<td>087100</td>
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<tr>
<td>1 Cylinder Housing</td>
<td>CR3070-178- MK</td>
<td>626</td>
<td>RU</td>
<td>087100</td>
</tr>
<tr>
<td>1 Interchangeable Core</td>
<td>CR8000-</td>
<td>626</td>
<td>RU</td>
<td>087100</td>
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<td>1 Automatic Opener</td>
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<td>463-RKW</td>
<td>US32D</td>
<td>RO</td>
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<tr>
<td>1 Threshold</td>
<td>___A FHSVL14 as detailed</td>
<td>PE</td>
<td>087100</td>
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<tr>
<td>1 Gasketing</td>
<td>by door mfg.</td>
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<tr>
<td>1 Sweep</td>
<td>315CN</td>
<td>PE</td>
<td>087100</td>
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<tr>
<td>1 Electric Power Transfer</td>
<td>EL-CEPT</td>
<td>SU</td>
<td>087100</td>
<td></td>
</tr>
<tr>
<td>1 ElectroLynx Harness Frame</td>
<td>PoE-C____PRJ</td>
<td>MK</td>
<td>087100</td>
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</tr>
<tr>
<td>1 ElectroLynx Harness Door</td>
<td>PoE-C____PRJ</td>
<td>MK</td>
<td>087100</td>
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<tr>
<td>2 Push Plate</td>
<td>639</td>
<td>NO</td>
<td>087100</td>
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<tr>
<td>1 Keyswitch</td>
<td>MKAN</td>
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<td>087100</td>
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<td>1 Power Supply</td>
<td>BPS-24-2</td>
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Diablo Valley College
D-4002 SRC Increment 2

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Door Hardware
5/30/2019
### Set: 23.0

Doors: 181AB

<table>
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<th>Item</th>
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<td>3 Hinge (heavy weight)</td>
<td>T4A3386 x NRP 4.5 x 4.5</td>
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<td>MK 087100</td>
</tr>
<tr>
<td>1 Rim Exit Device</td>
<td>AX 98L-NL ALK 996L-NL</td>
<td>US32D</td>
<td>VD 087100</td>
</tr>
<tr>
<td>1 Cylinder Housing</td>
<td>CR1070-114- MK</td>
<td>626</td>
<td>RU 087100</td>
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<tr>
<td>1 Cylinder Housing</td>
<td>CR3070-178- MK</td>
<td>626</td>
<td>RU 087100</td>
</tr>
<tr>
<td>2 Interchangeable Core</td>
<td>CR8000-</td>
<td>626</td>
<td>RU 087100</td>
</tr>
<tr>
<td>1 Surface Closer</td>
<td>PR7500</td>
<td>689</td>
<td>NO 087100</td>
</tr>
<tr>
<td>1 Door Stop</td>
<td>463-RKW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Threshold</td>
<td>_A FHSL14 as detailed</td>
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<td></td>
</tr>
<tr>
<td>1 Gasketing</td>
<td>S773GR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Sweep</td>
<td>315CN</td>
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Notes: Local alarm by security.

### Set: 24.0

Doors: 182A

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<tr>
<th>Item</th>
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<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>1 Access Control Mort Lock</td>
<td>IN120-ML20134 W PSA BIPS C6</td>
<td>626</td>
<td>RU 281300</td>
</tr>
<tr>
<td>1 Viewer</td>
<td>622</td>
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<td>DCRM RO 087100</td>
</tr>
<tr>
<td>1 Balance of Hardware existing</td>
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</table>

END OF SECTION 080671
SECTION 08 11 15
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1  SUMMARY

A. Section Includes
1. Non-fire rated exterior steel doors and frames, with and without transoms and sidelites.
2. Fire resistance rated and non-fire rated interior steel door and window frames.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
1. Section 08 14 16 - Flush Wood Doors: Provision of flush wood doors.
2. Section 08 71 00 - Door Hardware: Provision of door hardware.
3. Section 08 80 00 - Glazing: Provision of glass and glazing.
4. Section 09 90 00 - Painting and Coating: For field painting primed doors and frames.

1.2  REFERENCES

A. ANSI - American National Standards Institute
1. A115 - Specifications for Steel Door and Frame Preparation for Hardware.
3. A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.

B. ASTM - American Society for Testing and Materials
6. E413 - Classification for Rating Sound Insulation.

C. DHI - Door and Hardware Institute
1. A115 - Specifications for Steel Door and Frame Preparation for Hardware.

D. Intertek Testing Agency
E.  NFPA - National Fire Protection Association
   1.  80 - Fire Doors and Windows.

F.  SDI - Steel Door Institute
   2.  105 - Recommended Erection Instructions for Steel Frames.
   3.  112 - Galvanized Standard Steel Doors and Frames.

G.  UL - Underwriters Laboratories Inc.

1.3  SUBMITTALS

A.  Product Data: Submit product data for each type of door and frame specified, including
details of construction, materials, dimensions, hardware preparation, core, label compliance,
sound ratings, profiles, and finishes.

B.  Shop Drawings: Submit shop drawings showing fabrication and installation of standard steel
doors and frames referenced to the Architect’s door mark and hardware group. Include details
of each frame type, elevations of door design types, conditions at openings, details of
construction, location and installation requirements of door and frame hardware and
reinforcements, and details of joints and connections. Show anchorage and accessory items.
1.  Provide schedule of doors and frames using same reference numbers for details and
openings as those on the Drawings.

1.4  QUALITY ASSURANCE

A.  Where indicated, provide fire rated frame assemblies that comply with NFPA 80, are
identical to frame assemblies whose fire resistance characteristics have been determined in
accordance with ASTM E152, and which are labeled and listed by UL or Intertek Testing
Agency.

PART 2 - PRODUCTS

2.1  MANUFACTURERS

A.  Acceptable Manufacturers: Republic Builders Products; Steelcraft Manufacturing Co.;
Kewanee; Stiles Hollow Metal; Curries, or equal.

2.2  MATERIALS

A.  Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled,
complying with ASTM A568.

B.  Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A568.

C.  Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, hot dipped
galvanized in accordance with ASTM A924 with A60 or G60 coating designation, mil
phosphatized.
D. Supports and Anchors: Fabricate of not less than 18 gauge sheet steel; galvanized where used with galvanized frames.

E. Inserts, Bolts, and Fasteners: Manufacturer’s standard units. Where items are to be built in at exterior walls, hot-dip galvanize in compliance with ASTM A153, Class C or D as applicable.

F. Shop Applied Paint: Apply after fabrication.
   1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1.

G. Finish: As specified in Section 09 90 00.

2.3 DOORS

A. Doors: Provide metal doors of ANSI grades and models specified below or as indicated on the Drawings or schedules:
   1. Exterior Doors: Provide doors with insulated core and complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
      a. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
   2. Door Louvers: Provide sightproof stationary louvers where indicated, constructed of inverted V-shaped or Y-shaped blades formed of 24 gauge cold-rolled steel set into minimum 20 gauge steel frame.

B. Door Cores
   1. Core Stiffeners: Vertical steel stiffeners or steel channel grid.
   2. Core Filler: Sound deadening mineral composition, incombustible, moisture resistant, chemically inert in accordance with reviewed manufacturer’s recommendations.

2.4 FRAMES

A. Provide metal frames for doors and windows of types and styles as indicated on the Drawings and schedules. Conceal fastenings, unless otherwise indicated.
   2. Interior: Fabricate fully welded frames of minimum 18 gauge cold-rolled steel.
   3. Provide fire resistance frames with ratings as required and as indicated on the Drawings.

B. Door Silencers: Except on weatherstripped and smoke gasketed frames, drill stops to receive 3 silencers on strike jambs of single door frames and 2 silencers on heads of double door frames.

C. Door Hardware: As specified in Section 08 71 00.

2.5 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer’s plant.
Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at Project site. Comply with ANSI A250.8 requirements.

1. **Internal Construction:** Manufacturer’s standard vertical steel stiffeners or unitized steel grid with internal sound deadener on inside of face sheets where appropriate in accordance with ANSI standards.

2. **Clearances:** Not more than 1/8-inch at jambs and heads except between non-fire resistance rated pairs of doors not more than 1/4-inch. Not more than 3/4-inch at bottom.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.

C. **Tolerances:** Comply with SDI 117.

D. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold-rolled or hot-rolled steel.

E. Fabricate exterior doors, panels, and frames from galvanized sheet steel in accordance with SDI 112. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 14 gauge inverted steel channels.

F. **Exposed Fasteners:** Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

G. **Sound-Rated (Acoustical) Assemblies:** Where shown or scheduled, provide door and frame assemblies fabricated as sound-reducing type, tested in accordance with ASTM E90, and classified in accordance with ASTM E413.
   
   1. Unless otherwise indicated, provide acoustical assemblies with sound ratings of STC 33 or better.

H. **Glazing:** As specified in Section 08 80 00.

I. **Hardware Preparation:** Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI/DHI A115 Series Specifications for door and frame preparation for hardware.
   
   1. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.

J. Reinforce doors and frames to receive surface applied hardware. Drilling and tapping for surface applied hardware may be done at Project site.

K. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with DHI.

L. **Shop Painting:** Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
   
   1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

2.6 FINISHES

A. Finish Painting: As specified in Section 09 90 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories in accordance with final shop drawings, manufacturer’s data, and as herein specified.

B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated.
   1. Except for frames located at existing concrete, masonry or drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
   2. Install fire rated frames in accordance with NFPA 80.

C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI A250.8.

3.2 ADJUST AND CLEAN

A. Prime Coat Touch-Up: Immediately after erection, fill with compatible material, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Final Adjustments: Check and readjust operating hardware items, leaving steel frames undamaged and in complete and proper operating condition.

END OF SECTION
SECTION 08 11 17
ALUMINUM FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Interior aluminum door frames.
   2. Pre-finished, aluminum framing systems (including door frames and window) for interior use.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 07 92 00 - Joint Sealants: Provision of sealers and caulks.
   2. Section 08 14 16 - Flush Wood Doors: Provision of flush wood doors.
   3. Section 08 71 00 - Door Hardware: For furnishing of finish hardware.
   4. Section 08 80 00 - Glazing: Provision of glass and glazing.

1.2 REFERENCES

A. AA - Aluminum Association

B. AAMA - American Architectural Manufacturers Association
   1. 611 - Voluntary Standards for Anodized Architectural Aluminum.

C. ANSI - American National Standards Institute
   1. BHMA A156.16 - American National Standard for Auxiliary Hardware.

D. ASTM - American Society for Testing and Materials

E. AWS - American Welding Society
    1. A5.10 - Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.
    2. D1.2 - Structural Welding Code - Aluminum.
1.3 SYSTEM DESCRIPTION

A. General: Provide aluminum frames capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer’s standard units in assemblies similar to those indicated for this Project.

B. Dimensional Tolerances: Provide aluminum frames that accommodate dimensional tolerances of building frame and other adjacent construction.

1.4 SUBMITTALS

A. Product Data: Submit product data for each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.
   1. Include hardware schedule and indicate operating hardware types, quantities, and locations.

C. Samples: Submit samples of each type of exposed finish required in manufacturer’s standard sizes. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

D. Quality Control Submittals: Sealant compatibility and adhesion test reports from sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturers’ written interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

1.5 QUALITY ASSURANCE

A. Welding Standards: Comply with applicable provisions of AWS D1.2.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers
   1. Door Frames: Republic Builders Products; Steelcraft Manufacturing Co.; Kewanee; Stiles Hollow Metal; Curries, or equal.
   2. Framing System: Wilson Partitions; Frameworks, “Type II System”, or equal.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
   2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.
   3. Bars, Rods, and Wire: ASTM B211.
   4. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A36 for structural shapes, plates, and bars; ASTM A1011 for hot-rolled sheet and strip.

C. Glazing Gaskets: EPDM elastomeric extrusions.

D. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Section 07 92 00.

E. Bituminous Paint: Cold-applied asphalt mastic paint complying with SSPC Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

2.3 COMPONENTS

A. Frames: Based on partition stud depth and 5/8-inch gypsum board on each side; projected profile Type I; rectilinear design, 1-1/2 inch face profile; accepts 1/4-inch and 3/8-inch thick glass; coordinate series based on throat size.

B. Brackets and Reinforcements: Provide manufacturer’s standard brackets and reinforcements for hinges and strikes that are compatible with adjacent materials. Provide non-staining, non-ferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer’s standard corrosion resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
   1. Reinforce members as required to retain fastener threads.
   2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

E. Sound Seals: Manufacturer’s standard continuous mohair, wool pile, or vinyl seals.

F. Concealed Flashing: Manufacturer’s standard corrosion-resistant, non-staining, non-bleeding flashing, compatible with adjacent materials and of type recommended by manufacturer.

G. Hardware: As specified in Section 08 71 00.

H. Glass and Glazing Materials: As specified in Section 08 80 00.

2.4 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coping or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.
   1. Fabricate components for screw-spline frame construction.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

D. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

E. Fabricate door and window framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble frame units and factory install hardware to greatest extent possible. Reinforce frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
   1. Interior Door Frames: Provide ANSI/BHMA A156.16 silencers at stops to prevent metal to metal contact. Provide 3 silencers on strike jamb of single door frames and 2 silencers on head of double door frames.

2.5 FINISHES

A. General: Comply with NAAMM’s MFM for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of aluminum frames. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer’s written instructions for protecting, handling, and installing aluminum frames. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Install perimeter sealant, unless otherwise indicated. Comply with requirements of Section 07 92 00.

D. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

E. Erection Tolerances: Install aluminum frames to comply with the following maximum tolerances:
   1. Variation from Plane: Limit variation from plane or location shown to 1/8-inch in 12 feet; 1/4-inch over total length.
   2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16-inch. Where surfaces meet at corners, limit offset from true alignment to 1/32-inch.
   3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8-inch.

3.3 ADJUSTING AND CLEANING

A. Adjust frames and hardware to provide tight fit at contact points and sound seals, smooth operation, and weathertight closure.

B. Remove excess sealant and dirt from surfaces.
3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure aluminum frames are without damage or deterioration at the time of Substantial Completion.

END OF SECTION
SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Non-fire resistance rated flush solid core doors, with and without glazing.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   2. Section 08 11 17 - Aluminum Frames: Provision of aluminum door frames and framing systems.
   3. Section 08 71 00 - Door Hardware: For furnishing of finish hardware.
   4. Section 08 80 00 - Glazing: Provision of glass and glazing.
   5. Section 09 90 00 - Painting and Coating: For finish painting.

1.2 REFERENCES

A. AWI - Architectural Woodwork Institute

B. CALGreen - California Green Building Standards, 2016 Edition

C. DHI - Door and Hardware Institute
   2. WDHS-3 - Recommended Hardware Locations for Wood Flush Doors.

D. FSC - Forest Stewardship Council
   1. STD-01-001 - FSC Principles and Criteria for Forest Stewardship.

E. WDMA - Window and Door Manufacturers Association
   2. TR-4 - Conversion Varnish.
   3. TR-6 - Catalyzed Polyurethane.

F. UL - Underwriters Laboratories, Inc.

1.3 SYSTEM DESCRIPTION

A. Composite wood used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Articles 5.504.4.5 and 5.504.4.5.3.
1.4 SUBMITTALS

A. Product Data: Submit product data for each type of door, including details of core and edge construction and factory-finishing specifications.

B. Shop Drawings: Submit shop drawings indicating location and size of each door referenced to the Architect’s door mark and hardware group, elevation of each kind of door, details of construction, location and extent of hardware blocking, requirements for factory finishing and other pertinent data.
   1. For factory machined doors, indicate dimensions and locations of cutouts for locksets.

C. Samples for Verification: Corner sections of doors approximately 12 inches square with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required.

1.5 QUALITY ASSURANCE

A. Quality Standard: WDMA I.S.1-A.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C. Forest Certification: Provide doors made with not less than 70 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, “FSC Principles and Criteria for Forest Stewardship”.

1.6 WARRANTY

A. General Warranty: Door manufacturer’s warranty specified in this Article shall not deprive the District of other rights the District may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Door Manufacturer’s Warranty: Submit written agreement on door manufacturer’s standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4-inch in a 42 inch by 84 inch section or that show telegraphing of core construction in face veneers exceeding 0.01-inch in a 3 inch span, or do not conform to tolerance limitations of referenced quality standards.
   1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
   2. Warranty shall be in effect during the following period of time after date of Final Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Algoma Hardwoods, Inc.; Eggers Industries, Architectural Door Division; Marshfield DoorSystems, Inc., or equal.

2.2 MATERIALS

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. Interior Solid Core Doors for Transparent Finish
   1. Faces: Maple, quarter sliced to match existing as verified in the field.
   2. Grade: Premium with Grade AA faces.
   3. Construction: 5 plies.
   5. Core: Structural composite lumber.
   7. Assembly of Veneer Leaves on Door Faces: Center balance.
   8. Bonding: Stiles and rails bonded to core; then entire unit abrasive planed before veneering.

C. Glazing: As specified in Section 08 80 00.

D. Steel Door Frames at Existing Building: As specified in Section 08 11 15.

E. Hardware: As specified in Section 08 71 00.

2.3 FABRICATION

A. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI WDHS-3. Comply with final hardware schedules, door frame shop drawings, DHI A115-W series standards, and hardware templates.
   1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.

2.4 FINISHES

A. Factory Finishing: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Factory finish doors; finish faces, all 4 edges, edges of cutouts, and mortises.
   2. Transparent Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
      a. Grade: Premium.
      b. Color and Sheen: As selected by the Architect.

B. Field Painting: Transparent finish, as specified in Section 09 90 00.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: See Section 08 71 00.

B. Manufacturer’s Instructions: Install wood doors to comply with manufacturer’s instructions and referenced quality standard and as indicated.

C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Seal cut surfaces after fitting.
   1. Fitting Clearances for Non-Fire Resistance Rated Doors: Provide 1/8-inch at jambs and heads; 1/16-inch per leaf at meeting stiles for pairs of doors, and 1/8-inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4-inch clearance from bottom of door to top of threshold.
   2. Bevel non-fire resistance rated doors 1/8-inch in 2 inches at lock and hinge edges.

D. Finishing, General
   1. Before finishing doors, remove handling marks or effects of exposure to moisture with a complete, thorough final sanding over all surfaces of the door.
      a. Deep scratches shall be steamed out before sanding.
      b. Sharp edges shall be eased by sanding.
   2. Clean sanded doors before applying sealer or finish.
   3. Seal around all cutouts with 2 coats of varnish or sealer before hardware is set into place.

E. Field Finished Doors: See Section 09 90 00.

3.2 ADJUSTING AND PROTECTION

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

END OF SECTION
SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Access doors and frames.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Section
1. Section 09 90 00 - Painting and Coating: For finish painting.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s data completely describing products.

B. Shop Drawings: Submit drawings showing attachment to structure in each typical condition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS


2.2 MATERIALS

A. Non-Fire Rated
1. Flush steel door and flanged frame for gypsum board walls and ceiling installations.
2. Size: As indicated.

B. Fire Rated
1. Fire rated flush steel door and flanged frame, UL 1-1/2 hour rated, self latching with direct action knurled knob, for installation in rated walls.

C. Finishes
1. Steel: Chemically etch and apply baked-on rust inhibitive zinc dust prime coat.
2. Finish Painting: As specified in Section 09 90 00.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install access doors in accordance with manufacturer’s instructions and at locations authorized by the Architect in accordance with requirements for work of other Sections. Install access doors to provide access to concealed control and isolation valves.

B. Securely attach frames to supporting work and ensure doors operate smoothly and are free from warp, twist, and distortion.

3.2 ADJUSTING AND CLEANING

A. Thoroughly clean surfaces of grease, oil, or other impurities, touch-up abraded prime coat, and otherwise prepare for finish painting where required.

END OF SECTION
SECTION 08 33 13

COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Electric-operated rolling counter doors with integral frame, built-in type.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. AISI - American Iron and Steel Institute

B. NEMA - National Electrical Manufacturers Association

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data, roughing-in diagrams, and installation instructions for overhead coiling counter door.
   1. Provide operating instructions and maintenance information.

B. Shop Drawings: Submit shop drawings for special components and installations that are not dimensioned or detailed in manufacturer’s data sheets.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Furnish overhead coiling counter door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

B. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry for installation of overhead coiling counter door unit. Provide setting drawings, templates, instructions, and directions for installing anchorage devices. Coordinate delivery with other work to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Cornell Iron Works, Inc., “Rolling Counter Door with Integral Frame, Model ESC-10”, or equal.
2.2 COUNTER DOOR

A. Door Curtain
   1. Interlocked flat-faced slats, 1-1/2 inches high by 1/2-inch deep, 0.040-inch aluminum with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal.
   2. Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats.
   3. Finish: As selected by the Architect.
   4. Size for door opening width up to 10 feet high; mounted concealed above ceiling.

B. Head and Jamb Frame: Integral welded with guide groove incorporated into jamb design; build to fit wall thickness indicated on the Drawings.
   1. Stainless Steel: 16 gauge AISI 300 series formed shapes.
   2. Finish: Stainless steel, No. 4 finish.

C. Guides: Heavy-duty extruded aluminum sections with snap-on cover to conceal fasteners; provide polypropylene pile runners on both sides of curtain to eliminate metal to metal contact between guides and curtain; face of wall guide; finish to match door curtain.

D. Counterbalance Shaft Assembly
   1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.
   2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.

E. Brackets: Fabricate from reinforced AISI 300 series stainless steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures for hood.
   1. Finish: Stainless steel, No. 4 finish.

F. Hood and Fascia: Aluminum to match door curtain.

2.3 FABRICATION

A. Factory weld head and jambs into single unit, fully assembled, ready for installation.

2.4 OPERATION


B. Control Station: For use with motor operated units only.
   1. Flush Mounted: "Open/Close/Stop" push buttons; NEMA 1B; final selection by the Architect; location to be determined.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Commencement of work by installer is acceptance of substrate.

3.2 INSTALLATION

A. General: Install door unit and operating equipment with necessary hardware, anchors, inserts, hangers and supports.

B. Follow manufacturer's installation instructions.

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.4 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.5 DEMONSTRATION

A. Demonstrate proper operation to District's Representative.

B. Instruct District's Representative in maintenance procedures.

END OF SECTION
SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum-framed storefronts and entrances.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 07 92 00 - Joint Sealants: Provision of sealants.
   2. Section 08 63 00 - Metal-Framed Skylights: Provision of metal-framed skylights.
   3. Section 08 71 00 - Door Hardware: Provision of door hardware.
   5. Section 08 80 00 - Glazing: Provision of glass and glazing.

1.2 REFERENCES

A. AA - Aluminum Association

B. AAMA - American Architectural Manufacturers Association
   1. 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

C. ASTM - American Society for Testing and Materials

D. CBC - California Building Code, 2016 Edition
E. NAAMM - National Association of Mirror Manufacturers
   1. MFM - Metal Finishes Manual for Architectural and Metal Products.

F. NFRC - National Fenestration Rating Council

G. SSPC - The Society for Protective Coatings

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Provide aluminum storefront systems that comply with structural performance requirements indicated.
   1. Seismic Loads: Provide storefront systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to CBC.
   2. Deflection Normal to the Plane of the Wall: Test pressure required to measure deflection of framing members normal to the plane of the wall shall be equivalent to the wind load specified above. Deflection shall not exceed 1/360 of the clear span, when subjected to uniform load deflection test.
   3. Deflection Parallel to the Plane of the Wall: Test pressures required to measure deflection parallel to the plane of the wall shall be equal to 1.5 times the wind pressures specified above. Deflection of any member carrying its full dead load shall not exceed an amount that will reduce glass bite below 75 percent of the design dimension and shall not reduce the edge clearance between the member and the fixed panel, glass or other 1 fixed member above to less than 1/8-inch. The clearance between the member and an operable door or window shall be at least 1/16-inch.
   4. Glazing: Physically isolate glazing from framing members.
   5. Glazing to Glazing Joints: Provide glazing to glazing joints that accommodate thermal and mechanical movements of glazing and system, prevent glazing to glazing contact and maintain required edge clearances.

B. Performance Requirements
   1. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.
   2. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
   3. Finish hardware supplier shall be responsible for furnishing physical hardware to the entrance manufacturer prior to fabrication and for coordinating hardware delivery requirements with the hardware manufacturer, the General Contractor, and the entrance manufacturer to ensure the Project is not delayed.

1.4 SUBMITTALS

A. Product Data: Submit product data for each aluminum storefront system required, including:
   1. Manufacturer’s standard details and fabrication methods.
   2. Data on finishing, hardware and accessories.
3. Recommendations for maintenance and cleaning of surfaces.
4. Profiles and dimension of components.
5. Submit NFRC certification documentation showing compliance with California Title 24.
   a. Certification shall be based on the complete glazing system including framing, glazing, accessories, and components.

B. Shop Drawings: Submit shop drawings for aluminum storefront system required, including:
   1. Layout and installation details, including relationship to adjacent work.
   2. Elevations at 1/4-inch scale.
   3. Detail sections of typical composite members.
   4. Anchors and reinforcement.
   7. Entry door details, flashing details and other special conditions.
   8. Structural calculation for seismic and gravity loads on structural components of system. Drawings and calculations shall be by licensed engineer in the State of California and engineer shall be fully familiar with glazing systems.

C. Samples
   1. For Initial Color Selection: Submit pairs of samples of specified finish on 12 inch long sections of extrusions or formed shapes.
   2. For Verification Purposes: The Architect reserves the right to require additional samples, that show fabrication techniques and workmanship, and design of hardware and accessories.

D. Quality Control Submittals: Provide certified test reports from a qualified independent testing laboratory showing that aluminum storefront systems have been tested in accordance with specified test procedures and comply with performance characteristics indicated.

1.5 WARRANTY

A. Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:
   1. Structural failures including excessive deflection, excessive leakage or air infiltration.
   2. Faulty operation.
   3. Deterioration of metals, metal finishes and other materials beyond normal weathering.

B. Warranty Period: 2 years after the date of Final Completion.

C. The warranty shall not deprive the District of other rights or remedies the District may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers
   2. Entrances

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070-inch wall thickness at any location for the main frame and complying with ASTM B221; 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel, or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 or zinc-coated steel or iron complying with ASTM B633; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement as specified in Section 07 92 00.

F. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

2.3 STOREFRONT FRAMING SYSTEM

A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed, fasteners shall be stainless steel.

C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
D. Glazing: As specified in Section 08 80 00.
   1. Provide center glazed system to match existing.

E. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

F. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

G. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.4 ENTRANCES

A. Type 1: Provide manufacturer’s standard glazed doors for manual swing and slide operation.
   1. Door Construction: Minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
   2. Door Design: Medium stile.
   3. Dimensions: 3-1/2 inch vertical stile; 3-1/2 inch top rail; 10-inch bottom rail.
   4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets; provide nonremovable glazing stops on outside of door.
   5. At sliding door, provide break-away function on moving pane.

B. Type 2: Manufacturer’s standard glazed, insulated panel doors.
   1. Door Face: Architectural quality aluminum sheet, 0.090-inch thick, plain unpatterned.
   2. Dimensions: 5-inch vertical stile; 5-inch top rail; 5-inch bottom rail.
   4. Glazing: Insulated glass, as indicated in Section 08 80 00.

C. Hardware, General: As specified in Section 08 71 00.

2.5 FABRICATION

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   2. Profiles that are sharp, straight, and free of defects or deformations.
   3. Accurately fit joints; make joints flush, hairline and weatherproof.
   4. Physical isolation of glazing from framing members.
   5. Accommodations for mechanical movements of glazing and framing to maintain required glazing edge clearances.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
C. Storefront Framing: Fabricate components for assembly using manufacturer’s standard installation instructions.

D. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

### 2.6 ALUMINUM FINISH

A. General: Comply with NAAMM’s MFM for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Aluminum Finish: Superior performing organic coatings, AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) system.
   1. Polyvinylidene fluoride (PVDF) 3-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil (0.023 mm).
   2. Color: Charcoal to match existing.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine areas with the installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of storefront and entrance system. Do not proceed with installation until unsatisfactory conditions are corrected.

#### 3.2 INSTALLATION

A. General: Comply with manufacturer’s written instructions for protecting, handling, and installing storefront and entrance system. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
D. Install glazing to comply with requirements of Section 08 80 00.

E. Erection Tolerances: Install storefront system to comply with the following maximum tolerances.
   1. Variation from Plane: Limit variation from plane or location shown to 1/8-inch in 12 feet; 1/4-inch over total length.
   2. Diagonal Measurements: Limit difference between diagonal measurements to 1/8-inch.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality Control Testing: Perform the following tests on representative areas of aluminum-framed entrances and storefronts.
   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
   2. Air Infiltration: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
   3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 CLEANING

A. Remove excess sealant and glazing compounds, and dirt from surfaces.

END OF SECTION
SECTION 08 63 00
METAL-FRAMED SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fixed metal-framed skylight systems.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
1. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of sheet metal flashing and trim.
2. Section 07 92 00 - Joint Sealants: Provision of sealers.
4. Section 08 80 00 - Glazing: Provision of glazing standards.

1.2 REFERENCES

A. AAMA - American Architectural Manufacturers Association
   1. 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

B. ASTM - American Society for Testing and Materials
   3. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
12. **E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.**

C. **CBC - California Building Code, 2016 Edition**

D. **CCR - California Code of Regulations**

E. **DSA - Department of the State Architect**

F. **GANA - Glass Association of North America**

G. **IGCC - Insulating Glass Certification Council**

H. **NFRC - National Fenestration Rating Council**

I. **SSPC - The Society for Protective Coatings**

### 1.3 DEFINITIONS

A. Water Penetration: The appearance of uncontrolled water other than the condensation occurring on the interior surface of any part of the skylight.

### 1.4 SYSTEM DESCRIPTION

A. Performance Requirements
   1. General
      a. Provide the manufacturer’s metal framed skylights that have been adapted to the application indicated and comply with performance requirements specified as demonstrated by testing the manufacturer’s corresponding system according to test methods indicated.
      b. Unacceptable conditions include noise or vibration created by thermal movement, structural movement, or wind; thermal movement transferred to the building structure, and loosening, weakening or failure of fasteners, attachments or other components.
   2. Structural Performance: Design, engineer, fabricate and install metal framed skylights to withstand the effects of tributary loads specified in CBC.
   3. Thermal Movement: Provide for expansion and contraction of metal skylight components resulting from an ambient temperature differential of 120 Fahrenheit degrees, which may result in a metal surface temperature range of 180 Fahrenheit degrees within the skylight framing without causing buckling, excessive stresses on structural elements or fasteners, stresses on glazing, failure of seals, reduction of performance or other detrimental effects.
   4. Air and Water Infiltration: Design and install the metal framed skylight system to permanently resist air and water leakage through the system at a test pressure differential of 20 percent of the design loading in accordance with the following:
a. Air Infiltration: Air leakage through the skylight system shall not exceed 0.06 cfm per sq. ft. of assembly surface when tested in accordance with ASTM E283 at a minimum static air pressure differential of 1.57 lbf/sq. ft.

b. Water Penetration: There shall be no uncontrolled water leakage through the skylight when the assembly is tested in accordance with ASTM E331 at a minimum differential static pressure of 20 percent of the inward acting design wind load, but not less than 6.24 lbf/sq. ft.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s installation instructions and recommendations for maintenance. Include test reports that show compliance with Project requirements where test method is indicated.

1. Submit NFRC certification documentation showing compliance with California Title 24.
   a. Certification shall be based on the complete glazing system including framing, glazing, accessories, and components.

B. Shop Drawings: Submit fully dimensioned plans and elevations of units. Include sections at 1/2-inch scale and details at 3 inch scale or larger to show tolerances, member profiles, connections and fasteners, flashing and drainage. Indicate glazing method and pane opening sizes.

1. Clearly indicate the anchorage system, methods of interface with the building construction, field welding, if required, and provisions for expansion and contraction.
2. Include setting drawings, templates and directions for installation of anchor bolts and other anchorages installed under other Sections.
3. Show the adaptation of the manufacturer’s standard metal framed skylight system to the Project. Show clearly where and how the manufacturer’s system deviates from the Contract Drawings and Specifications.

C. Deferred Submittals (CCR Title 24, Part 1, Sec. 4-317(g)): Only where a portion of the construction cannot be adequately detailed on the approved plans because of variations in product design and/or manufacturer, the approval of plans for such portion, when specifically accepted by DSA, may be deferred until the material suppliers are selected, provided the following conditions are met:

1. The project plans clearly indicate that DSA approval of the deferred submittal is required for the indicated portions of the work prior to fabrication and installation.
2. The project plans and specifications adequately describe the performance and loading criteria for such work.
3. A California licensed architect or California registered engineer stamps and signs the plans and specifications for the deferred submittal item. The architect or engineer in general responsible charge of the design of the project shall submit the plans and specifications for the deferred submittal item to DSA, with notation indicating that the deferred submittal documents have been found to be in general conformance with the design of the building.
4. Fabrication of deferred submittal items shall not begin without first obtaining the approval of plans and specifications by DSA.
D. Samples for Initial Color Selection: Provide pairs of samples of each specified color and finish on 12 inch long sections of extrusions or formed shapes. Where normal color variations are anticipated, include 2 or more units in each set of samples indicating extreme limits of color variations.
   1. Submit 2 samples, not less than 12 inches by 12 inches in size, illustrating appearance of prefinished aluminum and specified glazing system, including glazed edge and corner.

E. Samples for Verification Purposes: The Architect reserves the right to require fabrication samples showing the following:
   1. Prime members.
   2. Joinery.
   3. Anchorage.
   5. Glazing and similar details.
   6. Profiles.
   7. Intersections.

F. Quality Control Submittals
   1. Structural Calculations: Provide complete structural calculations prepared in accordance with the AA SAS30 and the requirements of the Office of Regulation Services Division of the State Architect, bearing the seal of a structural engineer qualified in the design of self-supporting skylight assemblies and licensed in the State of California.
      a. Indicate the section moduli of wind load-bearing members.
      b. Include calculations of stresses and deflections for performance under 20 psf loading.
   2. Installer Certificates: Signed by the manufacturer certifying that the skylight installers comply with requirements indicated.
   3. Test Reports: Provide test reports from a qualified independent testing laboratory showing compliance of the metal framed skylight system with performance requirements indicated on the basis of the laboratory’s comprehensive testing of the system.

1.6 QUALITY ASSURANCE

A. Glazing Standards: Comply with recommendations of GANA “Glazing Manual” and “Sealant Manual” except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this Section or referenced standards.

B. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or on one component pane of unit, with the appropriate certification label of IGCC.

C. Design Criteria: The Drawings indicate sizes, profiles, and dimensional requirements of the metal framed skylights, and are based on the specific types and models indicated. Metal framed skylights by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.
D. Pre-Installation Conference: Before installing the skylights, conduct a pre-installation conference at the Project with the manufacturer, installer, and other interested parties to review procedures, schedules, and coordinate installation with other elements of the Work.

1.7 PROJECT CONDITIONS

A. Field Measurements: Take field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

1.8 SEQUENCING AND SCHEDULING

A. Schedule skylight installation in sequence with related elements of the Work specified in other Sections to ensure that assemblies, including flashing, trim and joint sealers, are protected against damage from weather, aging, corrosion and other causes.

1.9 WARRANTY

A. Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace skylights that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to, the following:
   1. Structural failure.
   2. Sealant failure
   3. Uncontrolled leakage.
   4. Deterioration of metal finishes beyond normal weathering.
   5. Failure of the skylight to meet performance requirements.

B. Warranty Period: 10 years after the date of Substantial Completion.

C. Glazing Materials: Provide the glass manufacturer’s standard warranty against delamination, seal failure, coating deterioration, and defects in manufacturing.

D. The Warranty submitted under this Section shall not deprive the District of other rights or remedies that the District may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Basis of Design is Glazing Vision, “Flushglaze Modular Fixed Skylight”, or equal.

2.2 MATERIALS

A. Skylight System: Fixed glazing system comprised of Qualicoat approved powder-coated aluminum extrusion and insulated double glazed unit.
   1. Dimensions: As indicated on the Drawings.
2. Pitch: Minimum 3 degrees.
3. Finish: As specified in Section 08 41 13.

B. Glazing
1. Laminated Glass Unit: ASTM C1172, safety, 2 ply factory laminated glass, 35.52 mm total thickness of the following:
   a. Pane 1: Low-E float glass, ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 8 mm thick, unless otherwise noted or where recommended by manufacturer to meet wind load requirements.
      1) Product: Basis of design is Saint Gobain, “SSG Climaplus Diamant”, or equal.
   b. Coating 2: As manufactured by Saint Gobain, “Cool-Lite Xtreme Silver II”, or equal.
   c. Cavity 1: 10 percent air, 90 percent argon, 16 mm.
   d. Pane 2: Low-E float glass, ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 5 mm thick, unless otherwise noted or where recommended by manufacturer to meet wind load requirements.
      1) Product: Basis of design is Saint Gobain, “SSG Climaplus Diamant”, or equal.
   e. PVB: Standard 1.52 mm.
   f. Pane 3: Low-E float glass, ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 5 mm thick, unless otherwise noted or where recommended by manufacturer to meet wind load requirements.
      1) Product: Basis of design is Saint Gobain, “SSG Climaplus Diamant”, or equal.
2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets. Laminate in autoclave with heat plus pressure.
3. Glazing is provided by skylight manufacturer; refer to Section 08 80 00 for glazing standards.

C. Gaskets and Joint Fillers: Provide the manufacturer’s standard permanent-type framing system gaskets and joint fillers for sliding joints, compression joint translation, or nonmoving joints depending on joint movement and sealing requirements.

D. Brackets and Reinforcements: Provide the manufacturer’s standard nonmagnetic stainless steel brackets and reinforcements.
1. Provide nonstaining, nonferrous shims to install and align skylight work.
2. At the fabricator’s option, brackets for anchorage to structure not exposed to weather or abrasion may be hot-dip galvanized steel complying with ASTM A123.

E. Fasteners and Accessories: Manufacturer’s standard noncorrosive fasteners and accessories that are compatible with materials used in the framing system and exposed portions of fasteners and accessories that match the finish of the skylights. Where movement is expected, provide slip-joint linings of sheets, pads, shims or washers of fluorocarbon resin or a similar material recommended by the manufacturer.
1. Framework Connections: Unless otherwise recommended by the skylight manufacturer, use either 300 series stainless steel fasteners that comply with ASTM A193, aluminum alloy 2024-T5 fasteners complying with ASTM B211, or aluminum rivets complying with ASTM B316, as required by the type of connection, for bolting aluminum extrusions and connecting members.
2. Connections to the Supporting Structure: Use zinc-coated steel fasteners complying with ASTM A307 for anchoring the skylight to the supporting structure.

3. Aluminum Cap Retainer Fasteners: Use stainless steel screws, complying with ASTM A193, series 300, type as recommended by the manufacturer for securing exterior aluminum cap retainers.

4. Where fasteners anchor into aluminum less than 0.125-inch thick, provide noncorrosive pressed-in splined grommet nuts or other type reinforcement to receive fastener threads.

F. Concealed Flashing: Provide dead-soft, minimum 0.018-inch thick stainless steel flashing, complying with ASTM A167, of the type selected by the manufacturer for compatibility.

G. Exposed Flashing and Closures: Sheet metal as specified in Section 07 62 00.

H. Touch-Up Primer: Provide zinc dust-zinc oxide primer for use over galvanized metal surfaces on the exterior.

I. Bituminous Paint: Provide cold applied asphalt mastic paint complying with SSPC Paint 12, formulated for 30 mil thickness per coat.

2.3 FABRICATION

A. General: Fabricate metal framed skylights to meet aesthetic and performance criteria indicated. Fit and assemble components in the manufacturer’s shop to the fullest extent practicable and prior to application of finishes.
   1. Before shipment, shop-assemble, mark and disassemble components that cannot be permanently shop assembled.
   2. Except were formed aluminum members are indicated, construct metal framed skylights with extruded aluminum components similar to sections indicated on the Drawings.

B. Fabricate components to allow for expansion and contraction, field adjustment, and minimum clearance and shimming at the perimeter. Fit and secure corners and joints rigidly with screw and spline, internal reinforcement or welding. Make exposed framing and trim joints and connections flush, hairline and weatherproof. Match exposed work to produce continuity of line.

C. Design and assemble components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members and moisture migrating within the system to the exterior.

D. Provide a continuous aluminum curb with expansion joints and locked and sealed or fully welded corners. Locate weep holes in the curb at each rafter connection to drain condensation.

E. Prepare components to receive anchor and connection devices and fasteners. Provide concealed connectors, attachments, and fasteners. Where fasteners exposed to view from interior are permissible, provide bolts and screws with countersunk heads. Provide acceptable exposed fasteners with finish matching the framing members or trim.
F. Where shop-welding is permissible or required use only the Gas Tungsten Arc Welding (TIG) or Gas Metal Arc Welding (MIG) process. Grind visible welds to a minimum of 100-grit finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the supporting structure and substrate for dimensions and tolerances, material conditions, and support before beginning the skylight installation. Carefully check provisions for anchorage and adjustment, allowances for expansion and contraction, and conditions of preset flashings and flashing connections.

B. Do not proceed until unsatisfactory conditions in affected areas have been corrected.

3.2 PREPARATION

A. Separate aluminum and other corrosible and dissimilar metals from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 INSTALLATION

A. Instructions: Comply with skylight and glazing material manufacturer’s instructions for protecting, handling and installing skylight components. Pay particular attention to preservation of applied finishes and use of sealants. Discard members damaged before installation and remove installed members that become damaged; provide new acceptable components.

B. Anchor components securely and permanently in place, shimming and using attachment methods that permit adjustment for construction tolerances, irregularities, and alignment. Allow for structural movement and changes due to varying thermal conditions.

C. Erection Tolerances: Install skylight components in place, plumb, level, accurately aligned and correctly located in reference to building features and without warpage or racking. Adjust framing to conform to the following tolerances:
   1. Plumb: 1/8-inch in 10 feet; 1/4-inch in 40 feet.
   2. Level: 1/8-inch in 20 feet; 1/4-inch in 40 feet.
   3. Alignment: Limit the offset from true alignment between 2 members abutting end-to-end, in line edge-to-edge, or separated by less than 3 inches to less than 1/32-inch; otherwise limit offsets to 1/8-inch.
   4. Location: Install framing with maximum deviation from measured theoretical plane or location of any member at any location to 1/8-inch per 12 feet of length or 1/2-inch in total length.

D. Welding: Where field welding is required or permissible in concealed locations use only Gas Tungsten Arc Welding (TIG) or Gas Metal Arc Welding (MIG) process. Take care to protect exposed finishes.

E. Coordinate installation and connections of seals and flashings at perimeter of assemblies to maintain continuity of thermal and water barriers.
F. Glazing: Inspect glazing material and framing for compliance with manufacturing and installation tolerances, including size, squareness and offsets at corners; edge or face clearances, and effective sealing. Comply with requirements of glazing material and glazing sealant manufacturers as recommended by the skylight manufacturer. Avoid point loading glazing material.

G. Perimeter Sealants and Joint Fillers: Install weathering sealant at connections of skylights to other materials as specified in Section 07 92 00.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality Control Testing: Perform the following tests on representative areas of skylights.
   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
   2. Air Infiltration: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
   3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.

C. Skylights will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 CLEANING

A. Clean the completed skylight, both metal and glazing material, inside and outside, promptly after erection, allowing for nominal curing of liquid sealants.
   1. Remove temporary protective coverings and strippable coatings from prefinished metal surfaces. Remove labels and part-number markings from all components.
   2. Wash exposed surfaces using a solution of mild detergent in warm water applied with soft clean cloths. Wipe clean. Take care to clean member connections and inside corners. Avoid use of harsh cleaning materials and methods that would damage metal finishes or glazing.

B. Remove remaining excess sealant by moderate use of solvent acceptable to the sealant manufacturer.

C. Follow recommendations of the skylight manufacturer for proper and adequate protection and cleaning procedures during the remainder of the construction period, so that the system will be without damage at the time of acceptance.

END OF SECTION
SECTION 087100
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding doors.
   3. Other doors to the extent indicated.
B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.
   3. Automatic operators.
   4. Cylinders specified for doors in other sections.
C. Related Sections:
   1. Division 08 Section “Door Hardware Schedule”.
   2. Division 08 Section “Hollow Metal Doors and Frames”.
   3. Division 08 Section “Interior Aluminum Doors and Frames”.
   4. Division 08 Section “Flush Wood Doors”.
   5. Division 08 Section “Automatic Door Operators”.
   6. Division 08 Section “Access Control Hardware”.
   7. Division 28 Section “Access Control”.
D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the
manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. California Building Code: Provide hardware that complies with CBC Section 11B.

1. All openings as a part of an accessible route shall comply with CBC Section 11B-404.

2. The clear opening width for a door shall be 32” minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34” and 4” maximum projections into it between 34” and 80” above the finish floor or ground. Door closers and stops shall be permitted to be 78” minimum above the finish floor or ground. CBC Section 11B-404.2.3.

3. Operable hardware on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34” minimum and 44” maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides. Applicable for lever-type hardware; panic bars, push-pull activating or U shaped handles, lever handle for thumb turn deadbolt.

4. Hardware (including panic hardware) shall not be provided with “nightlatch” function for any accessible doors or gates unless the following conditions are met:
   a. Such hardware has a ‘dogging’ feature and is dogged during the time the facility is open.
   b. All ‘dogging’ operation is performed only by employees as their job function (non-public use).

5. The force for pushing or pulling open a door shall be in accordance with CBC Section 11B-404.2.9.
   a. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 pounds (22.2 N) maximum. Required fire doors: the minimum opening force allowable by the Authority having Jurisdiction, may increase the maximum effort to operate fire doors to achieve positive latching, but not to exceed 15 pounds (66.7N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
b. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4.

6. Door closing speed shall comply with CBC Section 11B-404.2.8. Closers shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.

7. Floor stops shall not be located in the path of travel and 4” maximum from walls.

8. Thresholds shall comply with CBC Section 11B-404.2.5.

9. Where flush bolts occur in accessible route of travel, provide accessible flush bolt (automatic).

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of the hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Electrical component defects and failures within the systems operation.
C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
   1. Ten years for mortise locks and latches.
   2. Five years for exit hardware.
   3. Twenty five years for manual surface door closer bodies.
   4. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

   1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

   1. Quantity: Provide the following hinge quantity:

      a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:
   a. Hager Companies (HA).
   b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
   c. Stanley Hardware (ST).

B. Concealed Hinges: Hinges mortised into door and frame so that they are concealed when the door is closed. Hinges shall be adjustable three ways; vertically, horizontally and compression (in/out) capable of a 180 degree swing. Hinges are to be non-handed. Provide fastener type, size, and quantity as recommended by hinge manufacturer for properly installing concealed hinges in the door and frame type application. Provide steel receiver for metal door and frame cutouts for receiving concealed hinges.

1. Manufacturers:
   a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
   b. Soss Door Hardware.
   c. Tectus by Simonswerk.

C. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cutouts.
1. Manufacturers:
   a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
   b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
   a. Securitron (SU) - EL-CEPT Series.

B. Electrified Quick Connect Data Transfer Hinges: Provide combined electrified power and Ethernet data transfer hinges with Molex™ standardized plug connectors to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Data transfer hinges feature two 6-position and two 4-position Molex connectors, 9 multi-strand wires; 2 twisted pairs (26 AWG), 4 straight conductors (28 gauge) and 1 straight conductor (22 AWG) with concealed plug connectors eliminating the need for separate or exposed wiring. Rated 350 mA continuous @ 48 volts DC nominal, the hinge is capable of two PoE wiring configurations:
   a. Power over Data (5 wire): Power and Data supplied together over the 2 twisted 26 AWG pairs. The 22 AWG conductor is used for the earth ground connection.
   b. Data with Power over Spares (9 wire): Data over 2 twisted (26 AWG) pairs with Power over spare pairs 94 straight 28 AWG conductors). The 22 Awg conductor is used for earth ground connection.

2. Manufacturers:
   a. b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – PoE Series.
2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
   1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
   2. Furnish dust proof strikes for bottom bolts.
   3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
   4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
   5. Manufacturers:
      a. Door Controls International (DC).
      b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
      c. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
   1. Manufacturers:
      a. Corbin Russwin Hardware (RU).

C. Cylinders: Original manufacturer cylinders complying with the following:
   1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
   2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
   4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.
E. Security Cylinders: ANSI/BHMA A156.5, Grade 1, patterned security cylinders and keys able to be used together under the same facility master or grandmaster key system. Cylinders are to be factory keyed.

1. Manufacturers:
   a. Corbin Russwin (RU) - Pyramid PS Series.
   b. No Substitution.

F. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.

1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security and high security cylinders operated by one (1) key of the highest level. Geographical exclusivity to be provided for all security and high security cylinders and UL437 certification where specified.
   a. Level 1 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.
   b. Level 2 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders constructed to provide protection against bumping and picking.
   c. Level 3 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders to be UL437 certified and constructed to provide protection against bumping, picking, and drilling.
   d. Refer to hardware sets for specified levels.

2. Manufacturers:
   a. Corbin Russwin (RU) – Access 3 Series.

G. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Key locks to Owner's existing system.

H. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).

I. Construction Keying: Provide construction master keyed cylinders.
J. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

K. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:
   a. Lund Equipment (LU).
   b. MMF Industries (MM).
   c. Telkee (TK).

L. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into “Key Wizard” software.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:
   b. No Substitution.

B. Multi-Point Locksets, FEMA: Three-point locking system device engineered for in-swinging and out-swinging door applications on windstorm safe shelter rooms. Extra heavy duty steel component construction securing the door to the frame at top, bottom and center latch positions. All three latching points are automatically activated when the device is locked. Multi-Point Deadlocking System shall be used only with doors, frames and associated hardware that have been engineered, tested and approved for a complete opening assembly system.

1. ANSI-BHMA listed to A156.37 Grade 1 for multi-point locks:
   a. Lever torque to retract all bolts less than 28 in.lb.
   b. Cycle tested to 800,000 cycles.

2. NFPA 80 and NFPA 101 life safety requirements.

3. UL10B or UL10C, 3-hour fire rated openings.
4. Latchbolt Construction:
   a. Center Bolt to be one piece, ¾” throw anti-friction stainless steel latch and one piece, 1” throw, hardened stainless steel deadbolt; 2-3/4” standard backset.
   b. Top and Bottom Bolts to be ¾” x ¾” stainless steel square latchbolt with ¾” projection.

5. Independent top and bottom bolt projection shall be field adjustable:
   a. From the center mortise pocket.
   b. Ability to make field adjustments while the door is in the hung position without the removal of the door.
   c. Top and Bottom Bolts and the Center Mortise Case shall be factory installed into the door assembly.

6. Bottom strike shall be offset and reversible to accommodate alignment issues due to rough opening tolerances.

7. Devices must be able to accommodate sectional rose and lever trim to match the design style and architectural finishes of the balance of the lockset and latches as specified.

8. Devices must be available with electronic access control options for higher or everyday use and traceability.

9. Devices must be available with rod-dogging indicator options:
   a. Operated by single-point latching for non-emergency or normal use of the space.
   b. Ability to hold rods in a retracted state.
   c. Day-to-day operations with mortise lock only.
   d. Indicator to show status.

10. Manufacturers:
    a. Corbin Russwin Hardware (RU) - FE6600 Series.
    b. Sargent Manufacturing (SA) - FM7300 Series.
    c. No Substitution.

C. Residential Pivot Locking Devices

1. Pivot mechanism devices for push to open operation designed to fit ANSI standard door preps and ADA compliant.

2. Manufacturers:
   a. Yale Residential (YR) – PV Series.
   b. No Substitution.
2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.

b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.


9. Rail Sizing: Provide exit device rails factory sized for proper door width application.

10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:
   a. Detex (DE) - Advantex Series
   b. Von Duprin (VD) - 35A/98 XP Series.
   c. No Substitution.

C. Conventional Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Fabricate latchbolts from cast stainless steel, Pullman type, incorporating a deadlock feature.

1. Manufacturers:
   a. Adams Rite (AD) - EX Series.
   b. Cal Royal (CA) - 7700 Series.
   c. Falcon Hardware (FA) - 24/25 Series.
   d. Hager (HA) - 4500 Series.
   e. PDQ (PQ) - 6200 Series.
   f. Stanley Commercial (ST) - QED110 Series.
   g. Yale Locks and Hardware (YA) - 2100 Series.
   h. Yale Locks and Hardware (YA) - 6000 Series.

D. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

1. Provide keyed removable feature where specified in the Hardware Sets.
2. Provide stabilizers and mounting brackets as required.

3. Provide electrical quick connection wiring options as specified in the hardware sets.

4. Manufacturers:
   a. Von Duprin (VD) - 9954 Series.

2.9 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Manufacturers:
   a. Corbin Russwin Hardware (RU) - DC8000 Series.
   b. No Substitution.
C. Door Closers, Overhead Concealed (Narrow Profile): ANSI/BHMA 156.4 certified Grade 1 door closers designed for narrow profile frames and doors. Closers to have fully concealed body in the frame head for offset hung applications, with separate and independent valves for closing speed and backcheck adjustments.

1. Manufacturers:
   a. Rixson Door Controls (RF) - 91 Series.

2.10 ELECTROMECHANICAL DOOR OPERATORS

A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Standard: Certified ANSI/BHMA A156.19.

C. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.

2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.

E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19.

F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Norton Door Controls (NO) - 6300 Series.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates! are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:
   a. Hiawatha, Inc. (HI).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

2.12 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Floor stops shall be at 4” max from wall. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
a. Hiawatha, Inc. (HI).
b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:
   a. Rixson Door Controls (RF).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Sargent Manufacturing (SA).

2.13 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
2.14 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.15 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.


3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.
C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products as listed in the door hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Refer to Section 080671, Door Hardware Sets, for hardware sets.

END OF SECTION
SECTION 08 71 13

AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Entrance door operator and associated equipment.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections


2. Section 08 71 00 - Door Hardware: Provision of door hardware.


1.2 REFERENCES

A. AA - Aluminum Association

B. ANSI - American National Standards Institute


C. NAAMM - National Association of Architectural Metal Manufacturers

1. MFM - Metal Finishes Manual for Architectural and Metal Products.

D. NFPA - National Fire Protection Association

1. 80 - Fire Doors and Windows.

E. UL - Underwriters Laboratories Inc.

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Provide automatic entrance door system that complies with performance requirements indicated.

1. Wind Loads: Provide automatic entrance door assembly capable of withstanding wind pressures of 20 psf inward and 20 psf outward acting normal to the plane of the wall.

B. Performance Requirements

1. General: Provide automatic entrance door assembly that complies with performance characteristics specified as demonstrated by testing the manufacturer’s corresponding stock assemblies according to test methods indicated.

2. Thermal Movement: Design the automatic entrance door system to provide for expansion and contraction of the component materials. Door shall function normally over the specified temperature range.

   a. The system shall be capable of withstanding a metal surface temperature range of 180 degrees Fahrenheit without buckling, failure of joint seals, undue stress...
on structural elements, damaging loads on fasteners, reduction of performance, stress on glass or other detrimental effects.

3. Operator: Provide operator that will open and close the door and maintain it in fully closed position when subjected to a 20 mph wind velocity or the equivalent inward differential pressure.

1.4 SUBMITTALS

A. Product Data: Submit product data for automatic entrance, including the manufacturer’s standard details and fabrication methods and the following:
   1. Data on operators, hardware and accessories.
   2. Roughing-in diagrams.
   3. Parts lists.
   4. Data on finishes and recommendations for maintenance and cleaning of exterior surfaces.

B. Shop Drawings: Submit shop drawings for automatic entrance, including:
   1. Layout and installation details, including relationship to adjacent work.
   2. Elevations at 1/4-inch = 1 foot scale.
   3. Detail sections of typical composite members.
   4. Anchors and reinforcement.
   5. Hardware mounting heights.

C. Submit wiring diagrams detailing wiring for power operator, signal and control systems differentiating clearly between manufacturer installed wiring and field installed wiring.

D. Quality Control Submittals: Provide certified test reports from a qualified independent testing laboratory showing that automatic entrance door systems have been tested in accordance with specified test procedures and comply with performance characteristics indicated.

E. Contract Closeout Submittals: Submit manufacturer’s maintenance and service data for door operators and control system including the name, address and telephone number of the nearest authorized service representative.

1.5 QUALITY ASSURANCE

A. Qualifications
   1. Installer: For installation of the automatic entrance door, engage an experienced installer who is an authorized representative of the manufacturer for both the installation and maintenance of the type of units required for this Project.
      a. Maintenance Proximity: The installer shall maintain offices and repair or service facilities not more than 2 hours normal travel time from the Project site.
   2. Manufacturer: Provide automatic entrance doors produced by a firm experienced in manufacturing systems that are similar to those indicated for this Project and that have a record of successful in-service performance.

B. UL Standard: Provide powered door operators that comply with UL 325.
C. Emergency Exit Door: Automatic entrance door serving as a required means of egress shall comply with requirements of authorities having jurisdiction. Provide manufacturer’s certification that door complies with these requirements. Submit ICBO Report.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the Work.  
   1. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

1.7 WARRANTY

A. Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace components of the automatic entrance door system that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:  
   1. Structural failures including excessive deflection, excessive leakage or air infiltration.  
   2. Faulty operation of operators and hardware.  
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: 3 years after the date of Substantial Completion.

C. The warranty shall not deprive the District of other rights or remedies that the District may have under other provisions of the Contract Documents and is in addition to, and runs concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS


2.2 HARDWARE

A. General: Refer to Section 08 71 00 for requirements for hardware items other than those indicated to be provided by the entrance door operator manufacturer.

B. Provide heavy duty hardware units as indicated, scheduled or required for operation of entrance door, including the following items of sizes, number, and type recommended by the manufacturer for the service required. Finish hardware items to match finish of the door.

C. Capacity: Provide operator of the size recommended by the manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for the type of occupancy indicated.
D. Exposed Housing: Provide extruded or formed aluminum housing for operators of 0.062-inch minimum thickness with fasteners concealed when door is in the closed position. Provide access for maintenance.

E. Adjustment Features: Operators shall be fully adjustable without removal of the doors. Provide adjustment for opening, closing and checking speeds, as well as length of time the door remains open.

F. Electro-Mechanical Operators for Swinging Door: Provide self-contained, concealed, overhead electro-mechanical drive unit with power opening and either power or spring closing, and checking for both opening and closing cycles. Include connections for power and control wiring. Provide safety release clutch for obstructed closing. Provide for easy manual opening when power is off. Provide operator action as indicated.

G. Automatic Operation: Push button switch actuates door open; door closes after time delay expires. Opening and closing force, measured 1-inch out from the lock stile of the door, not to exceed 15 pounds of force to stop the door when operating in either direction.

1. Operator to include the following variable adjustments in compliance with ANSI Standard A156.19:
   a. Opening Speed: 4 to 6 seconds.
   b. Closing Speed: 4 to 6 seconds.

2.3 FABRICATION

A. General: Fabricate entrance door system components to design, sizes and thicknesses indicated and to comply with indicated standards.

B. Prefabrication: Provide entrance door operator as prefabricated packaged unit.

C. Reinforce the work as necessary for performance requirements and for support to the structure. Separate metal surfaces at moving joints with nonmetallic separators to prevent “freeze-up” of joints.

D. Dissimilar Metals: Separate dissimilar metals with bituminous paint, a suitable sealant, nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead.

E. Maintain continuity of line and accurate relation of planes and angles. Provide secure attachment and support at mechanical joints, with hairline fit of contacting members.

F. Fasteners: Conceal fasteners wherever possible.

2.4 FINISHES

A. General: Comply with NAAMM’s MFM for recommendations relative to finish applications and designations.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
C. Aluminum: As selected by the Architect.

PART 3 - EXECUTION

3.1 PREPARATION

A. Templates and Diagrams: Furnish templates, diagrams, and other data to fabricators and installers of related work, as necessary, for coordination of the automatic entrance door installation.

3.2 INSTALLATION

A. Comply with manufacturer’s specifications and recommendations.

B. Set units plumb, level and true to line without warp or rack of frames or door. Anchor securely in place. Separate aluminum and other corroisible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

C. Install complete door operator system in accordance with manufacturer’s instructions, including piping, controls, control wiring and remote power units.

D. Set tracks, header assemblies, operating brackets, rails and guides level and true to location with adequate anchorage for permanent support.

3.3 ADJUSTING

A. After repeated operation of completed installation, equivalent to 3 days use by normal traffic (100 to 300 cycles), readjust door operators and controls for optimum operating condition and safety and for a weathertight closure. Lubricate hardware, operating equipment, and other moving parts.

3.4 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that entrance door operator will be without damage or deterioration, other than normal weathering, at the time of acceptance.

END OF SECTION
SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Glass and glazing.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 06 41 10 - Custom Casework: Provision of custom casework.
   2. Section 08 11 15 - Steel Doors and Frames: Provision of steel doors and frames.
   6. Section 08 63 00 - Metal-Framed Skylights: Provision of metal-framed skylights.

1.2 REFERENCES

A. ANSI - American National Standards Institute

B. ASTM - American Society for Testing and Materials

C. CBC - California Building Code, 2016 Edition

D. CPSC - Consumer Product Safety Commission

E. GANA - Glass Association of North America

F. IGCC - Insulating Glass Certification Council
1.3 SYSTEM DESCRIPTION

A. Design Requirements
1. Provide glass and glazing that has been produced, fabricated, and installed to withstand movement without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials, and other defects in the work.

2. Glass Design: Glass thicknesses indicated on the Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
   a. Minimum glass thickness, nominally, of lites in exterior walls is 0.23-inches.
   b. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following: 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E1300. For other than monolithic annealed glass, determine thickness per glass manufacturer’s standard method of analysis including applying adjustment factors to ASTM E1300 based on type of glass.

3. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on materials’ actual surface temperatures due to both solar heat gain and nighttime sky heat loss.
   a. Temperature Change (Range): 120 degrees Fahrenheit ambient; 180 degrees Fahrenheit material surfaces.

4. Verify locations where safety glazing is required by CBC. Bring to the Architect’s attention locations not noted as such in the Drawings. Do not proceed until directed by the Architect.

5. Energy Requirements: As indicated on the Drawings.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each glass product and glazing material indicated.

B. Samples: Submit samples for verification purposes of 12 inch square samples of each type of glass indicated except for clear monolithic glass products, and 12 inch long samples of each color required for each type of sealant or gasket exposed to view. Install sealant or gasket sample between 2 strips of material representative in color of the adjoining framing system.
C. Quality Control Submittals

1. Test Reports
   a. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer’s interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.
   b. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.
   c. Product test reports for each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.
   d. Provide test reports stating NFRC certification and that storefront and glass system collectively meet the energy requirements indicated in the Drawings.

2. Certificates
   a. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.
   b. Separate certifications are not required for glazing materials bearing manufacturer’s permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Glass and glazing shall meet requirements of CBC Chapter 24.
   2. Safety Requirements: Provide glass and glazing complying with ANSI Z97.1 and CBC Chapter 24 and testing requirements of CPSC 16 CFR Part 1201 for Category II materials.
   3. Fire Resistive Glazing Products: Products identical to those tested in accordance with ASTM E2074 for doors and ASTM E2010 for window assemblies; both labeled and listed by UL.
   4. Insulating Glass Certification Program: Provide insulation glass units permanently marked with appropriate label of IGCC.

B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publication: “Glazing Manual”.

C. Single-Source Responsibility for Glass: Obtain glass from 1 source for each product indicated below:
   1. Heat-treated glass of each condition indicated, ASTM C1048.
   2. Insulating glass of each construction indicated.
D. Preconstruction Compatibility and Adhesion Testing: Submit to sealant manufacturers, samples of each glass, gasket, glazing accessory, and glass framing member that will contact or affect glazing sealants for compatibility and adhesion testing as indicated below

1. Use test methods standard with sealant manufacturer to determine if priming and other specific preparation techniques are required for rapid, optimum glazing sealants adhesion to glass and glazing channel substrates.

2. Submit not less than 9 pieces of each type and finish of glass-framing members and each type, class, kind, condition, and form of glass (monolithic, laminated, insulating units) for adhesion testing, as well as one sample of each glazing accessory (gaskets, setting blocks, and spacers) for compatibility testing.

3. Schedule sufficient time to test and analyze results to prevent delay in the Work.

4. Investigate materials failing compatibility or adhesion tests and get sealant manufacturer’s written recommendations for corrective measures, including using special primers.

5. Testing is not required when glazing sealant manufacturer can submit required preparation data that is acceptable to the Architect and is based on previous testing of current sealant products for adhesion to and compatibility with submitted glazing materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials to comply with manufacturer’s directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive the District of other rights the District may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer’s Special Warranty on Insulating Glass: Written warranty, made out to the District and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Viracon; Guardian Glass; Vitro Architectural Glass, or equal.
2.2 MATERIALS

A. Glass Types

1. Type 1 - Float Glass: ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 1/4-inch thick, unless otherwise noted or where recommended by manufacturer to meet wind load requirements.

2. Type 2 - Float Glass: ASTM C1048, Kind FT (fully tempered) Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 1/4-inch thick, unless otherwise noted or where recommended by manufacturer to meet wind load requirements.

3. Type 3 - Float Glass: Low-E, ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 1/4-inch thick, unless otherwise noted or where recommended by manufacturer to meet wind load requirements.

4. Type 4 - Float Glass: Low-E, ASTM C1048, Kind FT (fully tempered) Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 1/4-inch thick, unless otherwise noted or where recommended by manufacturer to meet wind load requirements.

5. Types 5 Through 9: Not used.

6. Type 10 - Laminated Glass Unit, Non-Skylight
   a. ASTM C1172, safety, 2 ply factory laminated glass, 1/2-inch total thickness of the following:
      1) Outboard Layer: Glass Type 1.
      2) Interlayer
         a. Polyvinyl butyral sheet, 0.030-inch thick, clear color.
         b. Product: As manufactured by Saflex, Monsanto Co., or equal.
      3) Inboard Layer: Glass Type 1.
   b. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets. Laminate in autoclave with heat plus pressure.

7. Type 11 - Laminated Glass Unit at Skylight: As specified in Section 08 63 00.

8. Types 12 Through 19: Not used.

9. Type 20 - Sealed Insulating Glass: Preassembled units composed of the following:
   a. Outboard Lite: Glass Type 3.
   b. Space: 12.7 mm argon.
   c. Inboard Lite: Glass Type 1.

10. Type 21 - Sealed Insulating Glass: Preassembled units composed of the following:
    a. Outboard Lite: Glass Type 4.
    b. Space: 12.7 mm argon.
    c. Inboard Lite: Glass Type 2.

2.3 GLAZING ACCESSORIES

A. Provide the following accessories as required.

1. Setting Blocks, Spacers, and Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
   a. Provide black spacers at sealed insulating glass; do not use silver.

3. **Glazing Tape:** Provide manufacturer’s standard solvent free butyl-polyisobutylene formulation with solids content of 100 percent; in extruded tape form; non-staining and non-migrating in contact with nonporous surfaces; packaged on rolls with release paper on 1 side; with or without continuous spacer rod as recommended by manufacturers of tape and glass for application indicated.

4. **Window Film:** Provide self-adhered, solar reducing tinted window film as manufactured by 3M, or equal.
   a. **Color:** Match existing.

### 2.4 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for the Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

#### 3.3 GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass from edge damage during handling and installation as follows
   1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer’s label.
2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
   1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously but not in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each lite is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Install gaskets so they protrude past face of glazing stops.

3.6 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.
SECTION 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Extruded aluminum fixed louvers and combination fixed louver and damper.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
   1. Section 07 92 00 - Joint Sealants: Provision of sealers and caulks.

1.2 REFERENCES

A. AAMA - American Architectural Manufacturers Association

B. AMCA - Air Movement and Control Association
   1. 500-D - Laboratory Methods of Testing Dampers for Rating.
   2. 500-L - Laboratory Methods of Testing Louvers for Rating.

C. ASTM - American Society for Testing and Materials

D. AWS - American Welding Society
   1. D1.2 - Structural Welding Code - Aluminum.

E. CBC - California Building Code, 2016 Edition

F. NAAMM - National Association of Architectural Metal Manufacturers
   1. MFM - Metal Finishes Manual.

G. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.

H. SSPC - The Society for Protective Coatings
1.3 DEFINITIONS

A. Louver Terminology: Refer to AMCA 501 for definitions of terms for metal louvers not otherwise defined in this Section or in referenced standards.
1. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
2. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements
1. Structural Performance: Engineer, fabricate and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.
2. Wind Load: Design and size members to withstand dead loads and live loads caused by pressure and suction of wind for design pressure in pounds per square foot in accordance with CBC and the following:
   a. Exposure: C.
   b. Wind Speed in Miles Per Hour: 110.
3. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
   a. Temperature Change (Range): 100 degrees Fahrenheit.
4. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturer’s stock units of height and width indicated. Louvers shall be certified to bear the AMCA Certified Ratings Program seal for air performance, wind-driven rain, and water penetration in accordance with AMCA Publication 511. Louvers shall be tested according to AMCA Standard 500-L for wind-driven rain and AMCA 500-D for dampers.
   a. Perform testing on unpainted, cleaned, degreased units.
   b. Perform water-penetration testing on louvers without screens.
   c. Equivalent Air-Performance Ratings: Louvers having less free area than that specified or having a lower free area velocity at the static pressure loss specified may be considered for the Work provided their total air performance is equivalent to that specified. The burden of proof of equivalency is on the Contractor. For louvers to be considered equivalent, the product of their free area, for the size specified, and their free area velocity at the static pressure loss specified must be at least equal to the product of the specified free area and velocity. Also, their free area velocity at the static pressure loss specified must not result in water penetration of more than 0.01 ounce per square foot of free area, and they must meet all other requirements.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each type of product specified.
B. Quality Control Submittals
1. Test Reports: Submit product test reports evidencing compliance of units with performance requirements indicated.
2. Certificates: Submit product certificates signed by louver manufacturers certifying that their products comply with the specified requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500-L and complying with the AMCA Certified Ratings Program.

1.6 QUALITY ASSURANCE

A. Welding Standards: Comply with applicable provisions of AWS D1.2.
1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Engineer Qualifications: California licensed professional engineer and experienced in providing engineering services of the kind indicated that have resulted in the installation of louvers similar to this Project in material, design and extent and that have a record of successful in-service performance.


1.7 PROJECT CONDITIONS

A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Greenheck; Ruskin; Construction Specialties, Inc.; Airolite Co., or equal.
1. Basis of Design: As indicated in Mechanical Louver Schedule.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are corrosive or incompatible with joined materials.
1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC Paint 12 except containing no asbestos fibers.

2.3 LOUVERS

A. Horizontal, Wind-Driven-Rain-Resistant, Drainable, Fixed-Blade Louver: Class A rating, greater than or equal to 99 percent effective, 6063-T5 aluminum frames and louver blades, designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions, complying with the following requirements:
1. Louver Depth: 6 inches, unless otherwise indicated.
2. Louver Size: As required by Mechanical.
3. Frame Thickness: 0.081-inch minimum or as required to comply with structural performance requirements.
4. Blade Thickness: 0.081-inch minimum or as required to comply with structural performance requirements.
5. Blade Angle: 45 degrees, unless otherwise indicated.
6. Provide rainwater scoop at attic side.
7. Provide louver frame with installation clips.

B. Combination Horizontal, Drainable, Fixed-Blade Louver with Operable Damper: Complying with the following requirements:
1. Louver Depth: 6 inches, unless otherwise indicated.
2. Louver Size: As required by Mechanical.
3. Frame Thickness: 0.125-inch minimum or as required to comply with structural performance requirements.
4. Blade Thickness: 0.60-inch minimum or as required to comply with structural performance requirements.
5. Blade Angle: 45 degrees, unless otherwise indicated.
6. Provide rainwater scoop at attic side.
7. Provide louver frame with installation clips.

2.4 SCREENS

A. General: Provide each exterior louver with screens complying with the following requirements:
1. Screen Location for Fixed Louvers: Interior face, unless otherwise indicated.
2. Insect Screening Type: 3/4-inch by 0.051-inch flattened, expanded aluminum in removable frame; prefinished in color to match louver; fasteners prefinished to match frame color.

B. Secure screens to louver frames with stainless-steel machine screws, spaced 6 inches maximum from each corner and at 12 inches on center between.

2.5 FABRICATION

A. General: Fabricate louvers to comply with requirements indicated for design, dimensions, materials, joinery, and performance.
B. Assemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Maintain equal louver blade spacing to produce uniform appearance.

E. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances of louvers, adjoining construction and perimeter sealant joints.

F. Include supports, anchorages and accessories required for complete assembly.

G. Provide vertical mullions of type and at spacings indicated but not more than recommended by manufacturer, or 72 inches on center, whichever is less. At horizontal joints between louver units, provide horizontal mullions except where continuous vertical assemblies are indicated.

H. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

I. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary:
1. With fillet welds, concealed from view.
2. With fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

2.6 FINISHES

A. General
1. Comply with NAAMM MFM for recommendations relative to applying and designating finishes.
2. Finish louvers after assembly.

B. Aluminum: Factory Kynar 500 fluoropolymer spray finish conforming to AAMA 605.2. Apply coating following cleaning and pretreatment. Dry louvers before final finish application.
1. Total Dry Film Thickness: 1.2 mils when baked at 450 degrees Fahrenheit for 10 minutes.
2. Color: As selected by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louver units plumb, level, and at indicated alignment with adjacent work. Install weather-lapped into building paper coursing at wall installations with flexible flashing comparable to window installations as detailed in Construction Documents.
B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make required alterations and refinish entire unit, or provide new units.

F. Protect nonferrous metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers and insulation, as louver installation progresses, where required to make louver joints weathertight. Comply with Section 07 92 00 for sealants applied during installation of louver.

3.2 ADJUSTING AND PROTECTION

A. Protect louvers from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.

B. Restore louvers damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by the Architect, remove damaged units and replace with new units at no additional cost to the District.
   1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.3 CLEANING

A. Periodically clean exposed surfaces of louvers that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Rinse surfaces thoroughly and dry.

END OF SECTION
SECTION 09 24 00
CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior portland cement plasterwork (stucco) with field-painted and integral color finish.
   1. Installation at existing building shall be on metal lath over weather resistive barrier over continuous sheathing.
   2. Installation at new building shall be over continuous insulation over air barrier over continuous sheathing.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 07 21 01 - Building Insulation: Provision of continuous insulation.
   3. Section 07 92 00 - Joint Sealants: Provision of joint sealants.
   4. Section 09 30 00 - Tiling: Provision of exterior ceramic tile.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials
   1. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ICC - International Code Council

C. NAAMM - National Association of Architectural Metal Manufacturers

D. PCA - Portland Cement Association
1.3 SYSTEM DESCRIPTION

A. Design Requirement: Cement plaster system includes components listed herein; system thickness 7/8-inch.

B. Performance Requirements
1. Provide exposed plaster finish surfaces that are true and even without waves, cracks or other imperfections. Cracks, blisters, pits or discoloration will not be acceptable.
2. Sheathing, lath and related accessories shall provide proper, secure base and reinforcement for plaster systems. Unless specifically noted otherwise, conform to NAAMM Standard Manual/SFA 920.
3. Provide accessories with custom grounds as indicated on the Drawings to accept cement plaster over continuous insulation installation.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data completely describing products and indicated compliance with ASTM standards.

B. Drawings: Submit elevation drawings showing layout of control joints. Submit dimensioned profile drawings for foam shapes.

C. Samples: Minimum 24 by 24 inch sample panels for review of finish texture by the Architect. Should sample panel be rejected, continue to submit until satisfactory texture is achieved. Sample passing review shall serve as standard of quality for the Project.

1.5 QUALITY ASSURANCE

A. Mockups: Before plastering, install mockup of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Install mockups for each type of finish indicated.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Continuous Insulation: Thickness as indicated on the Drawings; as specified in Section 07 21 01.

B. Weather-Resistive Barrier at Existing Building: 2-ply polymeric housewrap/asphalt saturated kraft Grade D breather type sheathing paper; complies with ASTM E2273, as manufactured by Fortifiber Building Systems Group, “Hydro Tex”, or equal.

C. Self-Adhering Flashing Sheet at Existing Building: Self-sealing, self-healing, fully adhered, composite flexible flashing. Flashing shall be 25 mil minimum thickness sheet consisting of rubberized asphalt integrally bonded to a high density, cross-laminated polyethylene film. The rolls shall be interwound with a disposable silicone-coated release sheet. Flashing shall be from rolls of 12 inch width.
1. Flexible Mastic or Flashing Compound: Compatible with flashing product, approved for use by manufacturer.
2. Primer: Manufacturer’s standard, water-based, excellent adhesion and aggressive tack, VOC-compliant, as manufactured by Grace Construction Products, “Perm-A-Barrier WB”, or equal.

D. Self-Adhering Air Barrier and Flashing Sheet at Existing Building: As specified in Section 07 27 15.


F. GPS Foam Shapes: Fabricated from molded expanded polystyrene foam board insulation, ASTM C578; hot wire cut in shop; provide basecoat/adhesive and reinforcing fiberglass mesh as recommended by the GPS manufacturer.

G. Plaster Base Coats
   1. Portland Cement: ASTM C150, Type I.
   2. Sand for Portland Cement Plaster: ASTM C897; graded in accordance with PCA requirements.
   4. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

H. Acrylic-Based Finish Coat: Factory-mixed formulation of acrylic emulsion, colorfast mineral pigments, and fine aggregates specifically recommended by acrylic-based finish manufacturer for use over portland cement plaster base coats; as manufactured by La Habra Products, Inc., or equal.
   1. Colors
      a. At Existing Building: Match existing.
      b. At New Building: Match exterior paint scheduled in Section 09 90 00.

I. Accessories: Provide minimum 26 gauge, G60 galvanized metals, unless otherwise indicated; provide accessories listed below or as indicated on the Drawings.
   1. Casing Beads: As manufactured by Cemco, “#66”, or equal; where indicated, provide Amico, “CI-Weep Trac”.
      a. Provide custom ground sized to fit both continuous insulation and 3-coat plaster as indicated on the Drawings.
   2. Vertical Control Joint: As manufactured by Cemco, “#XJ15”, or equal.
   3. Horizontal Control Joint: Solid leg, as manufactured by Cemco, “#15”, or equal.
   4. External Corner Bead: As manufactured by Stockton Products, “Corneraid”, or equal.
   5. Foundation Sill (Weep) Screed: Manufacturer’s custom J-profile screed with 1/2-inch diameter weep holes and 3.5-inch vertical attachment flange, fabricated from minimum 26 gauge zinc-coated (G90 galvanized) steel sheet, as manufactured by Stockton Products, or equal.
      a. Provide custom ground sized to fit both continuous insulation and 3-coat plaster as indicated on the Drawings.
6. Soffit Screed: As manufactured by Superior Metal Trim, “SSC Superior Soffit Corner”, or equal; where indicated, provide Amico, “CI-Weep Trac”.
7. Soffit Drip Edge: As manufactured by Cemco, #12”, or equal.
8. Soffit Vents: Provide soffit vents, with width as indicated on the Drawings, ASTM C1047, sheet steel zinc coated by hot-dip process. Flanges shall be free of dirt, grease and other materials that may adversely affect bond of joint treatment.

J. Fasteners: Comply with ASTM C1063 for type and size of fastener required to rigidly secure materials in place.

2.2 MIXES

A. Mix and proportion cement plaster in accordance with ASTM C926.

B. Scratch and Brown Coats
   1. Plasticizing Agents: 3 ounces of PRF per cubic foot. Add to water before adding cement and sand.
   2. Glass Fibers: Use fibers at the rate of 1/2 pound per sack of cement.


D. Proportions: In accordance with ASTM C926 and as follows:
   1. Scratch Coat: 1 part portland cement, 3-1/2 parts sand, 3 ounces PRF, 1/2-pound glass fibers.
   2. Brown Coat: 1 part portland cement, 4 parts sand, 1 part acrylic compound, 3 ounces PRF, 3 parts water.

2.3 FINISHES

A. Texture: Fine to match existing Campus buildings.

B. Finish Painting: As specified in Section 09 90 00.

PART 3 - EXECUTION

3.1 SELECTIVE DEMOLITION

A. Carefully cut back stucco to exposed 2 inches of undamaged lath and 6 inches of undamaged weather-resistant barrier. Edge of demolished stucco shall be "undercut" so that the exterior face of the remaining stucco extends beyond the remainder of the cut section.

3.2 INSTALLATION OF CONTINUOUS INSULATION AND WEATHER-RESISTIVE AND AIR BARRIERS

A. Continuous Insulation: Install in accordance with manufacturer’s written instructions and as specified in Section 07 21 01.
B. Weather-Resistive and Air Barriers: Also refer to Section 07 27 15.
1. Install weather resistive and air barriers where indicated in accordance with manufacturer’s written instructions and “best practice” recommendations.
2. Apply weather resistive and air barriers over wood sheathing or gypsum sheathing substrate. Lap and seal edges with accessories per manufacturer’s recommendations.

C. Self-Adhered Flashing: Course self-adhered flashing into all surrounding weather-resistive barriers. Self-adhered flashing shall be installed over solid backing. Where no backing is shown at details, provide 26 gauge galvanized metal sheet continuous.

3.3 INSTALLATION OF METAL LATH AND ACCESSORIES

A. Metal Lath Application
1. At cement plaster conditions on sheathing use Type SFB lath.
   a. Apply metal lath with long dimensions across supports, with ends lapped minimum 2 inches and staggered in adjacent courses; sides lapped minimum 2 inches.
   b. If lapping between supports, lace ends together with tie wire.
   c. Wire tie accessories to lath.
   d. Furr out metal lath 1/4-inch over solid backing by self-furring lath or by special furring nails.
   e. Lap metal lath over flanges at control joints; do not continue lath across control joints.
2. Lath Attachment: Attach in accordance with ASTM C1063.
   a. Wood Framing with Continuous Rigid Insulation
      1) Minimum 0.120-inch shank, corrosion-resistant nail with 0.271-inch head with Windlock ULP 302 washer (minimum 1.25 inches diameter), lath plate, or equal with minimum 1-1/4 inches penetration into framing.
   or
      2) Minimum #8 corrosion-resistant wood screw with Windlock ULP 302 washer (minimum 1.25 inches diameter), lath plate, or equal with minimum 1-inch penetration into framing.
3. At Openings
   a. Hang lath at openings with cut-out to include at least 1 and possibly 2 opening corners.
   b. Horizontal joints in line with head or vertical joints in line with jamb will not be permitted.
4. Accessories
   a. Apply corner reinforcement at external plaster corners using single lengths without joints.
   b. Install casing beads at terminations of plaster surfaces unless otherwise indicated. All corners and splices shall be watertight.
   c. At horizontal channel screeds and reveals, lap weather-resistive barrier over upper flange.
   d. Control Joints: Install control joints in specific locations approved by the District’s Representative for visual effect as follows:
      1) As required to delineate plasterwork into areas (panels) of the following maximum sizes:
         a) Vertical Surfaces: 144 sq. ft.
         b) Horizontal and other Nonvertical Surfaces: 100 sq. ft.
2) At distances between control joints of not greater than 18 feet on center.
3) As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4) Where control joints occur in surface of construction directly behind plaster.
5) Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.
6) Where indicated in the Drawings.
e. Fasten at both ends and at maximum 12 inch centers to prevent dislodging or misalignment by subsequent operations.
f. Where plaster meets dissimilar material, terminate with plaster casing bead unless otherwise shown.
g. Install weep screed at all locations where walls terminate at decks or grade.
h. Install drip screed at all horizontal returns including window heads, soffits and other locations where drip profile is required to shed water.

B. Do not fasten lath at recessed sills to avoid lath fasteners penetrating sill membrane where water may penetrate into the building.

C. Plaster Parapet Copings: Do not fasten through flexible flashing on horizontal surfaces.

3.4 MIXING

A. Mix materials in approved mechanical mixers of type in which quantity of water can be controlled accurately and uniformly.
   1. Avoid excessive mixing or agitation.
   2. Discard plaster which has begun to set before it is used; retempering will not be permitted. Do not use caked, or lumped materials.
   3. Mix ready-mixed plaster in accordance with manufacturer’s printed instructions.

3.5 PLASTER APPLICATION

A. Methods and workmanship for portland cement plastering shall meet requirements ASTM C926 and manufacturer’s recommendations.

B. Plaster Staging Joints
   1. Schedule work so that entire area, bounded by natural breaking points, is completed top to bottom within 1 day period for each scratch, brown and finish coat.
   2. Do not stop brown coat, except at an “architectural break”.
   3. Score finish plaster at junction with metal frames.

C. 3-Coat Application: Apply scratch coat to a nominal thickness of 3/8-inch, brown coat to a nominal thickness of 3/8-inch and a finish coat to a nominal thickness of 1/8-inch.

D. 2-Coat Application at Concrete Masonry Units and Concrete Where Indicated: Apply 3/8-inch scratch coat and 1/8-inch finish coat in compliance with ASTM C926 for plaster bonded to solid base.
   1. Apply bonding agent in accordance with manufacturer’s written installation instructions.
E. Finish Coat: Apply in accordance with manufacturer’s written instructions.

F. Plaster Curing: Moist cure plaster base and finish coats. Minimum curing for first 2 coats is 7 days each coat and final coat is 7 days. Keep plaster continuously moist during curing period. Take special precautions on days of extreme weather to prevent too rapid drying and cracking of plaster.

G. Finish Painting: As specified in Section 09 90 00.

3.6 TOLERANCES

A. Maximum Variation from True Flatness: 1/8-inch in 10 feet, with maximum inward and outward allowance not occurring in less than 20 feet.

3.7 ADJUSTING

A. Upon completion, point-up plaster around trim and other locations where plaster meets dissimilar materials.

B. Cut out and patch defective or damaged plaster, stained or discolored finished plaster, and conditions in violation of these Specifications by removing and replacing with acceptable work.

END OF SECTION
SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Gypsum board screw attached to metal and wood framing and furring members, joint treatment, and accessories.
2. Installation of sound deadening insulation in walls and ceilings and including acoustical sealant, tape, and the like for work of this Section.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
1. Section 05 45 00 - Metal Support Assemblies: Provision of metal support assemblies.
2. Section 07 21 01 - Building Insulation: Provision of building insulation.
3. Section 07 92 00 - Joint Sealants: Provision of caulking and sealants and backer rod.
4. Section 09 90 00 - Painting and Coating: For finish painting.
5. Section 10 11 00 - Visual Display Surfaces: Provision of visual display surfaces.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials
4. C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

B. CBC - California Building Code, 2016 Edition

C. CFR - Code of Federal Regulations

D. EPA - Environmental Protection Agency
E. GA - Gypsum Association
   1. 201 - Using Gypsum Board for Walls and Ceilings.
   2. 214 - Recommended Levels of Gypsum Board Finish.

F. UL - Underwriters Laboratories Inc.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data. Include the following:
   1. Fire Resistance Data: Include required fire test results for gypsum board systems on partitions and ceilings.
   2. Sound Transmission Data: Include certified evidence that installed gypsum board systems and materials meet required STC levels.

1.4 QUALITY ASSURANCE

A. Fire Test Response Characteristics: Where fire resistance rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
   1. Fire Resistance Ratings: As indicated by GA File Numbers in GA 600 or design designations in UL FRD or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier. Verify board and accessories as undamaged.

B. Storage and Protection
   1. Store materials inside under cover and keep dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
   2. Handle gypsum boards to prevent damage to edges, ends and surfaces.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Establish and maintain environmental conditions for application and finish gypsum board to comply with ASTM C840 and with gypsum board manufacturer’s recommendations. Maintain not less than 40 degrees Fahrenheit minimum room temperature.
   1. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during day, hot weather to prevent materials from drying too rapidly.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: United States Gypsum Co.; Georgia Pacific; Gold Bond Building Products Div., National Gypsum Co.; Pacific Coast Building Products, Pabco Gypsum Division, or equal.

2.2 MATERIALS

A. Gypsum Board Types
   1. Type 1: Fire rated board for fire resistance rated assemblies, ASTM C1396, Type X, tapered edges, 48 inches wide, 5/8-inch thick.
   2. Type 2: Fire rated water resistant board, Type X, tapered edges, 48 inches wide, 5/8-inch thick.

B. Screws: ASTM C1002, machine thread for gypsum board to metal attachments.

C. Nails: ASTM C514, wood thread for metal or gypsum board attachment to wood.

D. Insulation: As specified in Section 07 21 01.

E. Adhesives: Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Corner Beads and Casing Beads: ASTM C1047, sheet steel hot dipped galvanized. Use square corner beads at all corners throughout.

G. Joint Treatment Materials: Products of one manufacturer conforming to ASTM C475, ASTM C840, and recommendations of manufacturer of both gypsum board and joint treatment materials for application indicated. Conform to GA 201 and GA 216 for reinforcing tape, joint compound, and water.
   1. Joint Tape
      a. Cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape as recommended by setting type joint compound manufacturer.
      b. For silicone treated gypsum backer board, use 2 inch wide, 10-inch by 10-inch woven glass mesh tape.
   2. Setting Type Joint Compound: Factory prepackaged, job mixed, chemical hardening powder products formulated for uses indicated or factory premixed product. Use hot type at exterior gypsum soffits.

H. Acoustical Sealant: As specified in Section 07 92 00.

I. Backer Rod: As specified in Section 07 92 00.

J. Resilient Sound Isolation Wall and Ceiling Clip
   1. Isolation clip shall consist of a rubber element into which a standard galvanized steel furring channel, 7/8-inch by minimum 25 gauge, is captured. The channel legs snap fit into the rubber element without any metal-to-metal or other rigid contact with building elements.
2. Clips shall have sufficient capacity to support wall or ceiling weights as constructed. Design load capacity shall be based on a safety factor where the load to failure, defined as pullout of the channel from the clip, is a minimum 2.5 times the allowable maximum design load. Anchors for attachment of the clips to the substructure shall be selected to support wall and/or ceiling weights at each clip.

3. The isolation clip is attached to the wall/ceiling framing or other structural substrate through galvanized steel brackets on each side of the rubber isolation element. The brackets shall be of sufficient strength to carry the wall or ceiling weight without bending or failure.


2.3 FINISHES

A. Levels of Gypsum Board Finish as Defined by GA 214. Levels of finish as indicated on the Drawings or as selected by the Architect.

1. Level 0: No taping, finishing, or accessories required.

2. Level 1: All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

3. Level 2: All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

4. Level 3: All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes.

5. Level 4: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes.

6. Level 5 - Typical Unless Otherwise Indicated: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer’s recommendations, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of finish paint.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Gypsum Board
   1. Install and finish gypsum board to comply with ASTM C840 or GA 216.
      a. Single Layer: Install in accordance with ASTM C840, except as amended or
         required by specific fire resistive or sound isolation system detailed. In that
         instance, application shall conform to requirements of the manufacturer’s tests
         as reviewed and accepted in the submittal.
      b. Double Layer: Conform to applicable portions of ASTM C840, System
         Classification VIII for installations applied with screws. Conform to required
         fire resistance standards.
   2. Apply in horizontal direction with ends and edges falling on supports. Gypsum board
      shall be of maximum length possible to reach full wall or ceiling lengths with minimal
      number of joints.
   3. Position boards so that like edges abut, tapered edges against tapered edges and field
      cut ends against field cut ends. Do not place tapered edges against cut edges or ends.
      Stagger vertical joints over different studs on opposite sides of partitions.
   4. Start installation of panels at exterior wall to position butt joints as far away from
      exterior wall as possible.

B. Fire Resistant Assemblies: Wherever fire rated gypsum board construction is indicated,
   provide materials and installation methods, including types and spacing of fasteners, in
   accordance with CBC, GA Manual, or listed assembly indicated. Apply firestopping at top of
   wall and at penetrations through fire resistant assembly.

C. Penetrations Through Sound-Rated Construction: Existing sound-rated construction is
   present, and modifications shall be made in a manner that preserves sound rating. Cut-outs
   shall be regular and not fracture core or tear covering of gypsum board and meet the
   following requirements:
   1. Minimize penetrations of insulated wall and ceiling constructions. Penetrate only
      where necessary and fully seal airtight at the perimeter using acoustical sealant.
   2. Where ducts and piping greater than 3 inches diameter penetrate insulated wall or
      ceiling construction, provide a clearance of 1 inch plus or minus 1/4-inch at the
      perimeter of the penetration.
   3. Where conduit piping 3 inches diameter and less (including mechanical, hydraulic,
      plumbing, etc.) pass through insulated wall or ceiling construction, provide a clearance of 1/4-inch plus or minus 1/8-inch between the conduit or piping and the
      structure, unless otherwise indicated.
   4. After the ductwork, conduit, or piping has been installed, repair the gypsum board
      perimeter clearance to the specified tolerance as required. Where the clearance
      exceeds 3/4-inch, provide a sheet metal sleeve within the partition packed with safing
      insulation batts and caulk both sides airtight with an acoustical sealant. Where the
      perimeter clearance exceeds 3/8-inch, use a flexible backing rod to caulk against.
   5. Where penetration clearances are 3/8-inch or less, caulk airtight with acoustical
      sealant at gypsum board.
   6. All gypsum board penetrations (including those resulting from wiring, cables, and
      electrical junction boxes) are to be sealed airtight with acoustical sealant.
7. The back and sides of junction boxes in sound rated construction shall be sealed airtight with sheet caulking. Caulk perimeter face at gypsum board with acoustical sealant.
8. Recessed panel boards, equipment, boxes, etc., with penetration area greater than 25 square inches at sound rated partitions shall be fully enclosed and sealed with 5/8-inch thick gypsum board.
9. Seal multiple conduit penetrations airtight with expanding fire foam sealant.
10. Seal other sound rated conditions with spray-applied (40 pcf) cementitious sealant, as manufactured by Grace Construction Products, “Monokote Z-146”; Rust-Oleum; Uline, or equal.

D. Wet Locations at Restrooms
   1. At Walls and Ceilings: Conform to ASTM C840, System Classification X.
   2. Treat cut edges and holes in water resistant gypsum board with sealant.

E. Fastenings: Attach gypsum board to framing with screws, lengths and sizes as recommended by manufacturer and in accordance with CBC.

F. Accessories
   1. Install square corner beads at vertical and horizontal external corners with fasteners.
   2. Install casing beads whenever edge of gypsum board would otherwise be exposed or semi-exposed, or where abutting dissimilar materials.
   3. Install expansion joints where indicated on the Drawings.
   4. After accessories are installed, correct surface damage and defects.
   5. Install trims and expansion joints where required.

G. Resilient Sound Isolation Wall and Ceiling Clip
   1. General: Install work in accordance with the manufacturer’s approved product installation procedures.
   2. Spacing and location of sound isolation clips shall be determined by the manufacturer based on wall or ceiling type. Installation drawing details shall be provided by the manufacturer to assure optimum sound control and structural integrity of the system.

H. Allowable Tolerances
   1. Offset Between Planes of Board Faces: 1/16-inch.
   2. Plane, Level, Warp and Bow: 1/8-inch in 8 feet.
   3. Shim panels as necessary to comply with tolerances.

3.2 FINISHING OF GYPSUM BOARD

A. Apply joint treatment at gypsum board joints; flanges of corner bead, edge trim and penetrations, fastener heads and surface defects in accordance with ASTM C840 or GA 216. Number of coats of treatment shall be as specified above.

B. Finish Painting: As specified in Section 09 90 00.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Exterior ceramic tile.
   2. Setting beds, flashing, grouts, and accessories as required for complete tile installation.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   2. Section 09 24 00 - Cement Plastering: Provision of exterior cement plaster system.

1.2 REFERENCES

A. ANSI - American National Standards Institute
   7. A118.4 - Latex-Portland Cement Mortar.
   8. A118.6 - Standard Cement Grouts for Tile Installation.
   9. A118.12 - Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
   10. A137.1 - Ceramic Tile.

B. TCNA - Tile Council of North America

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each type of product specified.
B. Samples: Submit samples for initial selection purposes in form of manufacturer’s color charts consisting of actual tiles or sections of tile showing full range of colors, textures, and patterns available for each type and composition of tile indicated. Include samples of grout and accessories involving color selection.

1.4 MAINTENANCE

A. Extra Materials: Deliver extra materials to the District’s Representative. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

B. Tile and Trim Units: Furnish quantity of full size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers
   1. Tile: Crossville, Inc.; Daltile; Ariostea Legni; Summitville Tiles, or equal.
   2. Tile Setting and Grouting Materials: Custom Building Products; Laticrete International, Inc.; MAPEI Corporation, or equal.

2.2 MATERIALS

A. Tile Materials: Comply with ANSI A137.1.
   1. Colors, Textures, and Patterns: As selected by the Architect from manufacturer’s full range of standard colors, textures, and patterns for products of type indicated, with minimum 0.6 percent coefficient of friction.
   2. Tile Grade: Standard Grade, unless otherwise indicated.
   3. Exterior Ceramic Tile
      a. Size: 12 inches by 24 inches.
      b. Color: Kosmos UPS, AV303.
      c. Product: As manufactured by Crossville, Inc., “Moonstruck”, or equal.


C. Waterproof Membrane: As specified in Section 07 27 15.

D. Setting Bed and Grouting Materials
   1. Metal Lath: 3.4 lbs. galvanized diamond wire lath fastened through rigid insulation to wall studs. Installation as specified in Section 09 24 00.
3. Standard Sanded Cement Grout: ANSI A118.6, color as indicated.
      Products, “Prism® RS Ultimate Performance Grout”, or equal.
4. Water: Potable, free from impurities detrimental to tile work.
5. Grout Cleaner: As recommended by the tile manufacturer.
6. Sealer: As recommended by the tile manufacturer.

E. Wall Profiles
   1. Type A: Profile with trapezoid-perforated anchoring leg that is secured in the mortar
      bond coat beneath the tile to provide a slim, elegant corner.
   2. Type B: Profile with trapezoid-perforated anchoring leg that is secured in the mortar
      bond coat beneath the tile and a reveal that forms a flat surface.

2.3 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with requirements of referenced standards and
   manufacturers including those for accurate proportioning of materials, water, or additive
   content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time,
   and other procedures needed to produce mortars and grouts of uniform quality with optimum
   performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove existing floor tile and adhesive materials where indicated to provide a clean,
   structurally sound concrete slab free of contaminates.

B. Apply floor leveling primer as recommended by the self-leveling underlayment manufacturer.

C. Apply self-leveling underlayment in accordance with manufacturer’s written instructions.
   Apply from 0 inches to 2 inches to bring floor substrate to the required plane.

3.2 INSTALLATION, GENERAL

A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation
   standards included under “American National Standard Specifications for the Installation of
   Ceramic Tile” that apply to type of setting and grouting materials and methods indicated.

   with TCNA installation methods indicated.

C. Tile Blending: For tile exhibiting color variations within the ranges selected during sample
   submittals, verify that tile has been blended in factory and packaged accordingly so that tile
   units taken from one package show the same range in colors as those taken from other
packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.

F. Jointing Pattern: Lay tile in pattern as indicated on the Drawings. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.

H. Grout tile to comply with the following requirements:

1. For ceramic tile grouts and latex portland cement grouts, comply with ANSI A108.10.
2. Grout spacing width between tiles shall not exceed 1/4-inch.
3. Seal grout joints at time of completion.

3.3 EXTERIOR TILE INSTALLATION


1. Installation of Tile: ANSI A108.1A, 1B, or 1C.

3.4 CLEANING AND PROTECTION

A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer’s printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
a. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

3. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

4. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.
   a. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
   b. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

5. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION
SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Suspended acoustical ceiling systems, ACT-1, ACT-4, and ACT-5.
2. Acoustic ceiling panels where required to match existing.
3. Noise-control composite ceiling tiles, custom fabricated and ACT finished.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
1. Section 05 45 00 - Metal Support Assemblies: Provision of metal support assemblies.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials
2. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
7. E1264 - Classification for Acoustical Ceiling Products.

B. CBC - California Building Code, 2016 Edition

C. UL - Underwriters Laboratories Inc.

1.3 SYSTEM DESCRIPTION

A. Design Requirements
1. Design and detail ceilings to comply with requirements for seismic bracing and ceiling suspension according to CBC and ASTM E580.
2. Architectural reflected ceiling plan drawings shall govern over Mechanical and Electrical Drawings.
1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data completely describing products.

B. Shop Drawings: Show complete ceiling layouts, seismic bracing methods and details of installation, and information required for related work.

C. Samples: Provide 1 panel of each type of acoustical ceiling specified.

D. Quality Control Submittals
   1. Manufacturer’s Instructions: Submit manufacturer’s installation instructions.
   2. Certification: Provide manufacturer’s signed statement that gypsum board materials are asbestos free.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is approved by the acoustical ceiling manufacturer for installing the type of acoustical ceiling indicated for this Project.

B. Regulatory Requirements: Install fire rated ceiling systems in accordance with CBC and UL FRD listing and requirements of agency having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver and store packaged products in original containers with seals unbroken and labels intact until time of use.

B. Storage and Protection
   1. Keep materials dry by storing off ground; under watertight covers.
   2. Immediately before installation, panels shall be stored for sufficient time to stabilize temperature and humidity conditions ambient during installation and anticipated for occupancy.

1.7 PROJECT CONDITIONS

A. Environmental Requirements: Do not begin work until residual moisture has dissipated and comply with the following:
   1. Acoustical Ceilings: Maintain uniform temperature of minimum 60 degrees Fahrenheit and maximum of 90 degrees Fahrenheit and humidity of 20 to 40 percent but no more than 90 percent prior to, during and after installation.

1.8 SEQUENCING AND SCHEDULING

A. Schedule installation of acoustic units after interior wet work is dry.

B. Coordinate installation of ceilings with mechanical and electrical work.
1.9 MAINTENANCE

A. Extra Materials: Provide 5 percent extra quantity of each type of acoustical surface installed. Provide in original unbroken containers plainly marked with type and quantity of contents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Suspended Acoustical Ceiling, ACT-1
   1. Panels: Moisture resistant wet formed mineral fiber with factory applied vinyl latex paint, mildew resistant, recycled content, and with the following properties:
      b. Light Reflectance: Minimum LR 0.90 in accordance with ASTM E1264.
      c. NRC Range: 0.65.
      d. Edge: Beveled tegular.
      e. Surface Burning Characteristics: Class A in accordance with ASTM E84, with flame spread 25 or under.
      g. Product: To match existing Campus Standard; as manufactured by Armstrong World Industries, Inc., “Cirrus Second Look II”, or equal.
   2. Mechanical Suspension System: Heavy-duty, non-fire rated, exposed grid system for square edge ceiling panels, double-web tees, steel body with exposed surfaces factory painted with baked polyester paint.
      a. Provide panel centering devices built into each grid member.
      b. Pull out tension values greater than 300 pounds.
      d. Product: To match existing Campus Standard; as manufactured by Armstrong World Industries, Inc., “Prelude 15/16-Inch”, or equal.

B. Suspended Acoustical Ceiling, ACT-2: Not used.

C. Suspended Acoustical Ceiling, ACT-3: Not used.

D. Suspended Acoustical Ceiling, ACT-4
   1. Panels: Moisture resistant wet formed mineral fiber with factory applied vinyl latex paint, mildew resistant, recycled content, and with the following properties:
      a. Size: 24 inches by 48 inches.
      b. Light Reflectance: Minimum LR 0.89 in accordance with ASTM E1264.
      c. NRC Range: N/A.
      d. Edge: Square lay-in.
      e. Surface Burning Characteristics: Class A in accordance with ASTM E84, with flame spread 25 or under.
   2. Mechanical Suspension System: Heavy-duty, non-fire rated, exposed grid system for ceiling panels, double-web tees, steel body with exposed surfaces factory painted with baked polyester paint; complies with ASTM C635.
a. Provide panel centering devices built into each grid member.
b. Pull out tension values greater than 300 pounds.
d. Product: As manufactured by Armstrong World Industries, “Prelude 15/16-Inch”; Rockfon (Roxul Inc.), or equal.

E. Suspended Acoustical Ceiling, ACT-5
1. Panels: Noise-control ceiling tiles; high CAC composite consisting of a mineral fiber facing tile with a viscoelastic dampening layer and layer of gypsum board, and with the following properties:
   b. Thickness: 3/4-inch facing tile with bonded 11/16-inch gypsum board and dampening layers.
   c. CAC: Minimum 0.49 in accordance with ASTM E1414.
   d. NRC: Minimum 0.60 in accordance with ASTM C423.
   e. Edge: Beveled tegular.
   f. Facing Tile: To match existing Campus Standard; as manufactured by Armstrong World Industries, Inc., “Cirrus Second Look II”.
   g. Surface Burning Characteristics: Class A in accordance with ASTM E84, with flame spread 25 or under.
   h. Color: White.
   i. Product: As manufactured by Kinetics Noise Control, Inc., “QuietTile”; no known equal.
2. Mechanical Suspension System: Heavy-duty, non-fire rated, exposed grid system for square edge ceiling panels, double-web tees, steel body with exposed surfaces factory painted with baked polyester paint.
   a. Provide panel centering devices built into each grid member.
   b. Pull out tension values greater than 300 pounds.
   d. Product: To match existing Campus Standard; as manufactured by Armstrong World Industries, Inc., “Prelude 15/16-Inch”, or equal.

F. Replacement Acoustic Panels Where Indicated: Match existing adjacent panels.

G. Fasteners and Attachments
1. Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft temper, with gauge in accordance with CBC.
2. Angle-Type Hangers: Angles with legs not less than 7/8-inch wide, formed from 0.0635-inch thick galvanized steel sheet complying with ASTM A653, G90 Coating Designation, with bolted connections and 5/16-inch diameter bolts.
3. Ceiling Clips: Minimum 13 gauge by 3/4-inch wide, as recommended by acoustical ceiling manufacturer.
4. Light Fixture Protection and Hold Down Clips: Provide light fixture protection panels, fasteners and hold down clips as required by UL FRD listing, manufacturer’s standard types.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive acoustical treatment and verify that:
   1. Installation of building components located in ceiling plenum is complete.
   2. Spacing, direction and details of grid members and supports to accommodate installation of light fixtures, diffusers and other ceiling located items are correct.
   3. Areas are clean and free of materials or rubble that could damage acoustical surfaces.

B. Do not start work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Suspended Ceiling System
   1. Install acoustical material and suspension system, including necessary hangers and other supporting hardware in accordance with manufacturer’s instructions and ASTM C636.
   2. Lay work out symmetrically about centers of rooms and provide symmetrical borders not less than half size of tile specified unless noted otherwise on the Drawings.
   3. Make penetrations through ceiling panels in such a manner to ensure tight fit and neat appearance. Center penetrations in tile unless otherwise noted.
   4. Where existing systems are to be repaired, make replacement components longest lengths possible. Mechanically attach new components to existing equivalent to splice requirements for new suspension system. Install flush, flat, and aligned with existing suspension members.

B. Suspension System
   1. Install in accordance with CBC.
   2. For Hanger and Lateral Bracing Wires: Install expansion bolts or ceiling clips as required.
   3. Hanger Wires
      a. Insert hanger wires around expansion bolts or through ceiling clips in accordance with Code and secure as specified for hanger wires following in this Article. Load test hanger wires as specified in Article titled “Field Quality Control” in this Section.
      b. Plumb hanger wires. Add counterbrace wires when hanger wires are more than 1 in 6 out of plumb.
   4. Provide additional metal framing and hanger wires to clear furred-area interferences with suspension system. Do not penetrate ductwork with hanger wires.
   5. Ceiling wires and unbraced ducts, pipes and similar type items shall be separated by at least 6 inches.
   6. Provide hanger wires at intersection of grid members.
   7. Provide hanger wire supports for all recessed light fixtures and mechanical items as required for total support independent of acoustical ceiling systems.
   8. Use of scrap or short-cut members is not permitted.
   9. Connect grid members with positive interlocking method as standard with reviewed manufacturer.
   10. Secure ends of suspension system members at 2 adjacent walls as indicated and leave floating at other 2 adjacent walls.
11. Interconnect carriers over 12 inches not interconnected to walls near free end with 16 gauge tie wire or a metal strut securely attached to prevent spreading.

12. Level grid assembly in each area after installation of mechanical and electrical equipment within 1/8\(\text{inch}\) in 12 inches or conforming to slope as appropriate to area of installation.

C. Repair of Existing Acoustical Ceilings: Where existing suspension systems are indicated to remain, replace acoustic panels that are damaged or stained to match existing adjacent panels.

3.3 FIELD QUALITY CONTROL

A. Acoustical Ceiling Connection Devices: Test devices for capability to support the following loads:
   1. Hanger Wires: 100 pounds in accordance with requirements of CBC.
   2. Lateral Force Bracing Wires: 200 pounds or actual design load whichever is greater, with safety factor of 2, in accordance with CBC.

3.4 CLEANING AND ADJUSTING

A. Remove damaged or soiled material and replace with new prior to the District’s acceptance of Project.

3.5 PROTECTION

A. Protect acoustical treatment installation from damage during remainder of construction.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Engineered wood grille ceiling panels, WD-2.
   1. Ceiling panels will also be installed as a wall surface in the Café.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 05 45 00 - Metal Support Assemblies: Provision of metal support assemblies.
   2. Section 07 21 01 - Building Insulation: Provision of black-faced insulation.
   4. Division 26 - Electrical: Provision of electrical work penetrating suspended ceiling system.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

B. CBC - California Building Code, 2016 Edition

C. CISCA - Ceilings and Interior Systems Construction Association

D. FSC - Forest Stewardship Council

E. UL - Underwriters Laboratories Inc.

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Architectural reflected ceiling plan drawings shall govern over Mechanical and Electrical Drawings.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data completely describing products.

B. Shop Drawings: Show complete ceiling layouts, methods and details of installation, and information required for related work.
C. Samples: Submit for approval a minimum 12-inch by 12-inch wood ceiling sample, in specified grille style, with finish applied.

D. Quality Control Submittals: Submit manufacturer’s installation instructions.

1.5 QUALITY ASSURANCE

A. Qualifications: Installer shall have completed at least 3 previous projects of similar size and complexity.

B. Regulatory Requirements: Install fire rated ceiling systems in accordance with CBC and UL FRD listing and requirements of agency having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver and store packaged products in original containers with seals unbroken and labels intact until time of use.

B. Storage and Protection
   1. Keep materials dry by storing off ground; under watertight covers.
   2. Immediately before installation, panels shall be stored for sufficient time to stabilize temperature and humidity conditions ambient during installation and anticipated for occupancy.
   3. Panels: Store flat and level in a fully enclosed space. Store panels in the room in which they will be installed for a minimum 72 hours immediately prior to ceiling installation. The temperature and humidity of the room shall closely approximate those conditions that will exist when the building is occupied. Panels must be stored off the floor.

1.7 PROJECT CONDITIONS

A. Environmental Requirements: Do not begin work until residual moisture has dissipated. Maintain uniform temperature of minimum 60 degrees Fahrenheit and maximum of 90 degrees Fahrenheit and humidity of 20 to 40 percent but no more than 90 percent prior to, during, and after installation.

1.8 SEQUENCING AND SCHEDULING

A. Schedule installation of wood ceilings after interior wet work is dry.

B. Coordinate installation of ceilings with mechanical and electrical work.

1.9 MAINTENANCE

A. Extra Materials: Provide 5 percent extra quantity of each type of wood ceiling installed. Provide in original unbroken containers plainly marked with type and quantity of contents.
PART 2 - PRODUCTS

2.1 MANUFACTURERS


2.2 ENGINEERED WOOD GRILLE CEILING PANEL SYSTEM

A. Wood Grille Ceiling Panels, WD-2
   2. Species: Western Hemlock with White Oak stain; solid wood, no veneer.
      a. At Café: Provide 1-3/8 inches and 5-1/4 inches at wall-mounted applications where custom-cut graphics are applied as indicated on the Drawings.
   5. Edge Profile: Square, unless otherwise indicated.
   7. Assembly Style: Cross piece backer.
   8. Panel Size: 12 inches by up to 10 feet as indicated on the Drawings.
   9. Reveal Scrim: Fabric as selected by the Architect. Provide at interior ceiling only.
   12. Note: Wood grille will be used at interior and exterior; mixed grain; UV coating required at exterior application.

B. Suspension System: Heavy-duty T-bar system, 15/16-inch, as recommended by the wood ceiling manufacturer. Provide with 360-black paint at ceiling suspension system where black-faced insulation occurs.

C. Attachment Devices: Size for 3 times the design load indicated in ASTM C635, unless otherwise indicated.
   1. Coordinate cutting of grille with installation of fire sprinkler, light fixtures, and ceiling devices.
   2. Seismic bracing and compression strut at ceiling system is required.

D. Black-Faced Insulation: As specified in Section 07 21 01.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive wood ceilings and verify that:
   1. Installation of building components located in ceiling plenum is complete.
   2. Areas are clean and free of materials or rubble that could damage wood ceiling surfaces.

B. Do not start work until unsatisfactory conditions are corrected.
3.2 INSTALLATION

A. Black-Faced Insulation: Install on stick-clips with black protective caps and using 3-M, “77N Contact Adhesive”, or equal. At all exposed conditions in occupiable spaces provide edge trim at edges of all wall installations. Where the insulation is not black, it must not be visible at joints between adjacent panels.
   1. Do not paint black-faced insulation or any other acoustically absorptive or porous surface.

B. Wood Grille Ceiling Panel System
   1. General: Install in accordance with manufacturer’s written instructions and CISCA’s “Ceiling Systems Handbook.”
   2. Attachment: Install wood panels directly to heavy-duty T-bar main runners as indicated on the Drawings and in accordance with all local codes and regulations.
      a. In lieu of screws, install with backer clips for panels that must be accessible.

3.3 CLEANING AND ADJUSTING

A. Remove damaged or soiled material and replace with new prior to the District’s acceptance of Project.

3.4 PROTECTION

A. Protect wood ceiling installation from damage during remainder of construction.

END OF SECTION
SECTION 09 65 00
RESILIENT FLOORING

PART 1 - GENERAL

1.1  SUMMARY

A. Section Includes
   1. Luxury vinyl tile, FF-1.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
   1. Section 09 97 25 - Vapor Emission Treatment Systems: Provision of vapor emission treatment system, as required.

1.2  REFERENCES

A. ADA - Americans with Disabilities Act

B. ASTM - American Society for Testing and Materials
   3. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. CALGreen - California Green Building Standards, 2016 Edition

D. CFR - Code of Federal Regulations

E. EPA - Environmental Protection Agency
1.3 SYSTEM DESCRIPTION

A. Adhesives used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.1.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each type of product specified.

B. Samples: Submit samples for initial selection purposes in form of manufacturer’s color charts consisting of actual sections of resilient flooring showing full range of colors and patterns available for each different product indicated.

1.5 MAINTENANCE

A. Extra Materials
   1. Furnish 1 box of each class, wearing surface, color, pattern, and size of resilient floor tile installed.
   2. Furnish 10 linear feet in roll form of each different composition, wearing surface, color, and pattern of sheet floor covering installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Luxury Vinyl Tile, FF-1: Complying with ASTM F1700; meets or exceeds ADA Guidelines.
   1. Class: Class 3, Type B.
   2. Size: 5.91 inches by 39.37 inches.
   4. Overall Thickness: 0.197-inch.
   5. Edge: Micro-bevelled.
   6. Installation: Refer to the schedule of interior finishes on Drawing Sheet A9.13.2.
   7. Static Load Limit: 750 psi.
   10. Color: Refer to the schedule of interior finishes on Drawing Sheet A9.13.2.

B. Sheet Vinyl Safety Flooring, FF-2
   1. Type: Heavy-duty safety flooring.
   2. Thickness: 0.12-inch (3 mm).
   5. Static Load Limit (ASTM F970): 2,000 psi.
   7. Color: Refer to the schedule of interior finishes on Drawing Sheet A9.13.2.
C. Medical Grade Sheet Vinyl, FF-3: Heterogeneous floor covering with glass fiber reinforcement, ASTM E648, Class 1, with the following properties:
1. Total Weight: 5.1 lb./sq. yd.
2. Thickness 2.0 mm.
3. Residual Indentation: Less than 0.1 mm.
4. Sound Reduction: Lw = 10 dB.
5. Recycled Content: 5 percent pre-consumer.
6. Color: Refer to the schedule of interior finishes on Drawing Sheet A9.13.2.

2.2 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex modified, portland cement based formulation provided or approved by resilient flooring manufacturer for applications indicated.

C. Adhesives: Waterproof, nonflammable, type as recommended by resilient flooring manufacturer.
   1. General: Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Sheet Flooring Adhesives: Not more than 50 g/L.
      b. Cove Base Adhesives: 50 g/L.
      c. Rubber Floor Adhesives: 60 g/L.
   2. Adhesives shall be compatible with vapor emission treatment systems specified in Section 09 97 25.
      a. Provide adhesive as recommended by resilient flooring manufacturer for tested moisture vapor emission rate of concrete, not to exceed 3.5 lb/24 hr/1000 sq. ft.

D. Rod for Heat-Welding Seams: Product of floor covering manufacturer in color complying with the following requirement.
   1. Match field color of resilient floor covering.

E. Transition Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of sheet floor coverings and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting resilient flooring performance. Verify that substrates and conditions are satisfactory for resilient flooring installation and comply with requirements specified.
B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the resilient flooring manufacturer.
   2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
   3. Concrete shall be allowed to cure for 90 to 120 days and must be properly sealed. Test concrete for vapor emission by the Calcium Chloride Moisture test method in compliance with ASTM F1869. Emission rate shall not exceed 3.5 lb/24 hr/1000 sq. ft. Treat with vapor emission treatment systems specified in Section 09 97 25, as required.

3.2 PREPARATION

A. General: Comply with manufacturer’s installation specifications to prepare substrates indicated to receive resilient flooring accessories.

B. Use patching compounds per manufacturer’s directions.

C. Grind high spots (over 1/8-inch) and clean concrete floors to remove stains, markings, dust, and debris.

D. Wash and rinse surfaces prior to installation of resilient flooring in accordance with flooring manufacturer’s recommendations. Protect other Work from staining or damage due to cleaning operations.

3.3 INSTALLATION

A. General: Comply with manufacturers’ installation directions and other requirements indicated that are applicable to each type of installation included in Project.

B. Resilient Tile Installation
   1. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.
   2. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
   3. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including, pipes, outlets, edgings, thresholds and nosings. Extend tiles into toe spaces, door reveals, closets, and similar openings.
   4. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.
   5. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.
6. Use full spread of adhesive applied to substrate in compliance with tile manufacturer’s directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

7. Hand roll tiles where required by tile manufacturer.

C. Sheet Flooring Installation
1. Lay out sheet floor coverings to comply with the following requirements:
   a. Maintain uniformity of sheet floor covering direction.
   b. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 6 inches away from parallel joints in flooring substrates.
   c. Match edges of resilient floor coverings for color shading and pattern at seams.
   d. Avoid cross seams.
2. Where demountable partitions and other items are indicated for installing on top of finished floor covering, install floor covering before these items are installed.
3. Scribe, cut, and fit sheet floor coverings to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture, including cabinets, pipes, outlets, edgings, thresholds and nosings.
4. Extend sheet floor coverings into toe spaces, door reveals, closets, and similar openings.
5. Maintain reference markers, holes or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.
6. Adhere sheet floor coverings to flooring substrates by method approved by floor covering manufacturer.
   a. Produce completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.
   b. Comply with floor covering manufacturer’s directions including those for trowel notching, adhesive mixing, and adhesive open and working times.
7. Heat-weld seams in sheet floor coverings where this seaming method is indicated. Prepare, weld and finish seams to produce a surface flush with adjoining sheets.
8. Hand roll sheet floor coverings in both directions from center out to embed floor coverings in adhesive and eliminate trapped air. At walls, door casings and other locations where access by roller is impractical, press floor coverings firmly in place with flat-bladed instrument.
9. Flooring edges which abut walls, door casings, and pipes shall be sealed with acrylic latex silicon caulk.
10. Upon completion of installation of linoleum, apply minimum of 3 coats of floor finish. Implement maintenance procedures in accordance with manufacturer’s warranty requirements.

D. Transition Strips: Install in accordance with manufacturer’s written instructions.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation:
1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers.
2. Sweep or vacuum floor thoroughly.
3. Do not wash floor until after time period recommended by manufacturer.
4. Damp-mop resilient flooring and accessories to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by tile manufacturer.

END OF SECTION
SECTION 09 65 13.13
RESILIENT BASE

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Rubber wall base, WB-1, and accessories.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES
A. ASTM - American Society for Testing and Materials

1.3 SUBMITTALS
A. Product Data: Submit manufacturer’s product data for each type of resilient base specified.
B. Samples: Submit samples for initial selection purposes in form of manufacturer’s color charts consisting of actual sections of wall bases showing full range of colors and patterns available for each different resilient base indicated.

1.4 MAINTENANCE
A. Extra Materials: Furnish 20 linear feet in roll form of each different composition, color, and pattern of resilient wall base installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Acceptable Manufacturers: Burke; Roppe Corporation, or equal.

2.2 MATERIALS
A. Rubber Wall Base, WB-1: Products complying with ASTM F1861.
   1. Style: Cove with top-set toe.
   3. Height: 4 inches.
   4. Lengths: Coils in lengths standard with manufacturer but not less than 100 feet.
   5. Interior and Exterior Corners and Ends: Premolded.
   6. Color: Refer to the schedule of interior finishes on Drawing Sheet A9.13.2.
2.3 INSTALLATION ACCESSORIES

A. Patching Compounds: Latex modified, portland cement based formulation provided or approved by resilient base manufacturer for applications indicated.

B. Adhesives: Waterproof, nonflammable, type as recommended by resilient base manufacturer.
   1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D5116:
      a. Total VOCs: 50 g/L.
      b. Formaldehyde: 0.05 mg/sq. m x h.
      c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting resilient base performance. Verify that substrates and conditions are satisfactory for resilient base installation and comply with requirements specified.

3.2 PREPARATION

A. General: Comply with manufacturer’s installation specifications to prepare substrates indicated to receive resilient base.

B. Use patching compounds per manufacturer’s directions.

3.3 INSTALLATION

A. General: Comply with manufacturers’ installation directions and other requirements indicated that are applicable to each type of installation included in Project.

B. Resilient Wall Base Installation
   1. Apply resilient wall base to walls, casework and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
   2. Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.

3.4 CLEANING AND PROTECTION

A. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers.
B. Protect resilient base against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by resilient base manufacturer.

END OF SECTION
SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Tile carpeting, CPT-1, CPT-2, CPT-3, and CPT-4.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
   1. Section 09 97 25 - Vapor Emission Treatment Systems: Provision of vapor emission treatment system, as required.

1.2 REFERENCES

A. AATCC - American Association of Textile Chemists and Colorists
   1. 134 - Electrostatic Propensity of Carpets.

B. ADA - Americans with Disabilities Act

C. ASTM - American Society for Testing and Materials
   4. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
   5. F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. CALGreen - California Green Building Standards, 2016 Edition

E. CRI - Carpet and Rug Institute
   1. 104 - Standard for Installation of Commercial Carpet.
   2. Green Label Plus Testing Program.

F. EPA - Environmental Protection Agency

G. FCIB - Floor Covering Installation Board

H. NFPA - National Fire Protection Association
I. State of California

1.3 SYSTEM DESCRIPTION

A. Performance Requirement: Carpet tile shall meet or exceed the CRI Green Label PLUS Program requirements or have been tested for low emissions according to State of California Specification 01350.

B. Carpet tile used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.4.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each type of carpet material and installation accessory required. Submit written data on physical characteristics, durability, resistance to fading, and flame resistance characteristics.

B. Samples
   1. Submit 3 minimum 12 inch square samples of each carpet type illustrating color, weave, texture and pattern.
   2. Submit manufacturer’s full range of color selections for carpet edge strips.

C. Contract Closeout Submittals: Provide maintenance data including the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer’s recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by FCIB or who can demonstrate compliance with its certification program requirements.

B. Regulatory Requirements
   1. Flammability
      a. Radiant Panel: Meets NFPA Class 1 when tested in accordance with ASTM E648.
      b. NBS Smoke: Less than 450 when tested in accordance with ASTM E662.
   2. Static Control: Less than 3.5 kv, built-in permanent conductive fiber in accordance with AATCC 134.
   3. Carpet pile height shall meet requirements of ADA.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Deliver materials to Project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.
B. Storage and Protection: Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, blocked off ground. Maintain minimum temperature of 68 degrees Fahrenheit at least 3 days prior to and during installation in area where materials are stored.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with CRI 104, Section 6.1. Do not install carpet tile until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Where casework, fixed seating, or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

A. Provide manufacturer’s standard lifetime limited warranty for fiber and backing system.
   1. Warranty shall be submitted to the District against product failure covering both labor and material in the following areas:
      a. Abrasive wear of fiber.
      b. Static protection of fiber.
      c. Tuftbind/zippering of backing.
      d. Edge ravel of backing.
      e. Integrity/delamination of backing.
      f. Integrity/dimensional stability of backing.

1.9 MAINTENANCE

A. Extra Materials
   1. Deliver extra materials to the District. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels describing contents.
   2. Carpet: Before installation begins, furnish quantity for each type of material equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Interface, Inc., or equal.

2.2 MATERIALS

A. Carpet Tile, CPT-1
   1. Size: 50 cm by 50 cm, modular.
   2. Dye Method: 100 percent solution dyed.
   5. Pattern: Cubic.
6. Style Number: 1380102500.
7. Color: Shape, 4287.

B. Carpet Tile, CPT-2
1. Size: 25 cm by 1 m.
2. Dye Method: 100 percent solution dyed.
6. Style Number: 28200AK00.

C. Carpet Tile, CPT-3
1. Size: 25 cm by 1 m.
2. Dye Method: 100 percent solution dyed.
6. Style Number: 38930AK00.
7. Color: Charcoal Weft, 105345.

D. Carpet Tile, CPT-4
1. Size: 25 cm by 1 m.
2. Dye Method: 100 percent solution dyed.
4. Installation Method: As indicated.
6. Style Number: 28200AK00.

2.3 ACCESSORIES

A. Adhesive: Water-based, clear acrylic co-polymer adhesive; solvent free, low odor, contains no hazardous chemicals; meets CRI Green Label criteria.
1. Provide adhesive with total VOC limit of 50 g/L when tested according to ASTM D5116.
2. Adhesives shall be compatible with vapor emission treatment systems specified in Section 09 97 25.
   a. Provide adhesive as recommended by tile carpeting manufacturer for tested moisture vapor emission rate of concrete, not to exceed 3.5 lb/24 hr/1000 sq. ft.

B. Carpet Edge Guards: Resilient molded rubber to match wall base, profile as detailed.

C. Thresholds: As detailed.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Verify that substrates and conditions are satisfactory for carpet tile installation and comply with requirements specified.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet tile manufacturer.
   2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
   3. Concrete shall be allowed to cure for 90 to 120 days and must be properly sealed. Test concrete for vapor emission by the Calcium Chloride Moisture test method in compliance with ASTM F1869. Emission rate shall not exceed 3.5 lb/24 hr/1000 sq. ft. Treat with vapor emission treatment systems specified in Section 09 97 25, as required.
   4. Before installing carpet tile, verify that concrete floors, regardless of age, comply with the moisture and pH requirements stated by the carpet tile manufacturer, and must otherwise be suitable for carpet tile installation.
      a. The moisture conditions of the concrete shall be determined by use of the In Situ probe relative humidity (rH) test method, ASTM F2170, using a moisture testing device manufactured by Wagner or Vasela. The testing device shall be properly maintained and calibrated in accordance with the manufacturer’s specifications and frequency recommendations. Certificates of calibration shall be maintained for test validation.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, “Site Conditions; Floor Preparation”, and carpet tile manufacturer’s written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Clear away debris and scrape up cementitious deposits from concrete surfaces to receive carpet; apply sealer to prevent dusting.

C. Remove coatings, including curing compounds and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer.

D. Use trowelable leveling and patching compounds, according to manufacturer’s written instructions, to fill cracks, holes, and depressions in substrates.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation or dust. Proceed with installation only after unsatisfactory conditions have been corrected.
F. Unwrap carpet in a well ventilated location prior to installation. Air the carpet out in off-site location such as a ventilated warehouse for at least 2 days prior to installation.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 13.

B. Carpet shall be installed after building has been painted and subjected to an airing out of at least a week by forced ventilation, with maximum outside air. Contractor shall ensure construction involving high VOCs and other pollutants will be completed before the airing out.

C. Comply with manufacturer’s recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under door in closed position; do not place seams perpendicular to door frame, in direction of traffic through doorway.

D. Extend carpet under removable flanges and furnishings and into alcoves and closets of each space.

E. Provide cutouts where required, and bind cut edges where not concealed by protective edge guards or overlapping flanges. Maintain reference markers, holes and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

F. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.

G. Observe CRI and EPA carpet air-out guidelines. Continuously operate the building ventilation system at normal temperature and maximum outdoor air during installation and for 72 hours after installation is complete. Avoid recirculating air from the installation area, through the heating, ventilation and air-conditioning system, and into occupied areas. Create a temporary exhaust system using fans, open doorways, stairwells, and windows. Seal return air grilles.

H. Recycle waste carpet. Provide carpet tiles larger than 1/2 tile to the additional material above the 5 percent extra materials specified above.

3.4 CLEANING

A. Remove adhesive from carpet surface with manufacturer’s recommended cleaning agent.

B. Remove and dispose of debris and unusable scraps.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure carpet is not damaged or deteriorated at time of Substantial Completion.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation, painting and finishing of new and existing exposed exterior and interior items and surfaces.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 05 50 00 - Metal Fabrications: For finish painting of miscellaneous metals.
   2. Section 06 10 00 - Rough Carpentry: For finish painting of rough carpentry.
   3. Section 06 20 00 - Finish Carpentry: For finish painting of finish carpentry.
   4. Section 06 41 10 - Custom Casework: For backpriming of custom casework.
   5. Section 07 21 19 - Foamed-In-Place Insulation: For painting of top coat at thermal barrier at roof.
   6. Section 07 62 00 - Sheet Metal Flashing and Trim: For finish painting of sheet metal flashing and trim.
   7. Section 08 11 15 - Steel Doors and Frames: For finish painting to steel doors and frames.
   8. Section 08 14 16 - Flush Wood Doors: For finish painting of flush wood doors.
   9. Section 09 24 00 - Cement Plastering: For finish painting of integral-colored exterior cement plaster system.
  10. Section 09 29 00 - Gypsum Board: For finish painting of gypsum board.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

B. CALGreen - California Green Building Standards, 2016 Edition

C. CARB - California Air Resources Board

D. FM - Factory Mutual

E. UL - Underwriters Laboratories Inc.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements
   1. Paint exposed surfaces whether or not colors are designated in the schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural.
2. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts and labels.
3. Do not paint over UL, FM, or other code required labels or equipment name, identification, performance rating or nomenclature plates.
4. Comply with CARB requirements for maximum volatile organic compound (VOC) content.

B. Paints and coatings used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Articles 5.504.4.3, 5.504.4.3.1 and 5.504.4.3.2.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data information, stating the material composition and analysis and the Material Safety Data Sheet (MSDS) on all paint to be used.

B. Samples
   1. Following the selection of colors and glosses by the Architect, submit samples for the Architect’s review.
      a. Provide 3 samples of each color and each gloss for each material on which the finish is specified to be applied.
      b. Make samples approximately 8 inches by 10 inches in size.
   2. Do not commence finish painting until samples are approved.

1.5 QUALITY ASSURANCE

A. Provide primers and undercoat paint produced by the same manufacturer as finish coats.
   1. Review other Sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrates.
   2. Provide barrier coats over non-compatible primers, or remove the primer and re-prime as required.
   3. Notify the Architect in writing of anticipated problems in using the specified coating systems over prime coatings supplied under other Sections.

1.6 MAINTENANCE

A. Upon completion of the work of this Section, deliver to the District an extra stock equaling 1 gallon of each color, type and gloss of paint used in the Work; tightly sealing each container, and clearly labeling with contents and location where used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Dunn Edwards; Sherwin Williams, and Kelly-Moore Paints are acceptable.
   1. Dunn Edwards is basis of design.
   2. Kelly-Moore Paints is Campus Standard.
2.2 **PAINT MATERIALS**

A. Paint Materials, General
   1. Material Quality: Provide manufacturer’s best quality trade sale paint material of the various coating types specified.
   2. Provide block fillers, primers, finish coat materials and related materials that are compatible with one another and the substrates.

B. Colors: Refer to the schedule of interior finishes on Drawing Sheet A9.13.2 and schedules at the end of this Section.
   1. Existing Building: Match existing colors unless otherwise indicated.

C. Pigment
   1. Pigment: To be no less than 24 percent and titanium dioxide to be no less than 20 percent of pigment by weight.
   2. Vehicle: To be no less than 72 percent and vinyl resin to be no less than 26 percent of vehicle by weight.

**PART 3 - EXECUTION**

3.1 **PREPARATION**

A. General: Mix and prepare paint materials in strict accordance with the manufacturers’ recommendations as approved by the Architect.

B. Surface Preparation
   1. General
      a. Perform preparation and cleaning procedures in strict accordance with the paint manufacturers’ recommendations as approved by the Architect.
      b. Remove removable items which are in place and are not scheduled to receive paint finish; or provide surface applied protection prior to surface preparation and painting operations.
      c. Following completion of painting in each space or area, reinstall the removed items by using workmen who are skilled in the necessary trades.
   2. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet newly painted surfaces.

C. Cementitious Materials: Prepare concrete and concrete masonry unit or board surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   1. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   2. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer’s written instructions.
   3. At concrete floors, ensure substrate is fully cured, clean, and etched for best adhesion in accordance with paint manufacturer’s recommendations.
D. Preparation of Wood Surfaces
1. Clean wood surfaces until free from dirt, oil, and other foreign substance.
2. Smooth finished wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
3. Unless specifically approved by the Architect, do not proceed with painting of wood surfaces until the moisture content of the wood is 12 percent or less as measured by a moisture meter approved by the Architect.

E. Preparation of Metal Surfaces
1. Thoroughly clean surfaces until free from dirt, oil and grease.
2. On galvanized surfaces, use solvent for the initial cleaning, and then treat the surface thoroughly with the phosphoric acid etch. Remove etching solution completely before proceeding.
3. Allow to dry thoroughly before application of paint.

3.2 PAINT APPLICATION

A. General
1. Touch-up shop-applied prime coats which have been damaged, and touch-up bare areas prior to start of finish coats application.
2. Slightly vary the color of succeeding coats.
3. Sand and dust between coats to remove defects visible to the unaided eye from a distance of 5 feet.
4. On removable panels and hinged panels, paint the back sides to match the exposed sides.

B. Drying: Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suite adverse weather conditions.

C. Brush Applications
1. Brush out and work the brush coats onto the surface in an even film.
2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness and other surface imperfections will not be acceptable.

D. Spray Application
1. Confine spray application to metal framework and similar surfaces where hand brush work would be inferior.
2. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
3. Do not double back with spray equipment to build up film thickness of 2 coats in 1 pass.

E. Miscellaneous Surfaces and Procedures
1. Exposed Mechanical Items
   a. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed.
   b. Paint visible duct surfaces behind vents, registers, and grilles flat black.
   c. Wash metal with solvent, prime and apply 2 coats of alkyd enamel.
2. Exposed Pipe and Duct Insulation
   a. Apply 1 coat of latex paint on insulation which has been sized or primed under other Sections; apply 2 coats on such surfaces when unprepared.
   b. Match color of adjacent surfaces.
   c. Remove band before painting, and replace after painting.
3. Hardware
   a. Paint prime coated hardware to match adjacent surfaces;
   b. Paint metal portions of head seals, jamb seals, and astragal seals to match the color of the door frame unless otherwise directed by the Architect.
4. Exposed Vents: Apply 2 coats of heat resistant paint approved by the Architect.

3.3 EXTERIOR PAINT SCHEDULE

A. Cement Plaster
1. 100 Percent Acrylic Elastomeric Coating: 2 finish coats over transparent sealer.
   b. Finish Coat(s): As manufactured by Dunn Edwards, “Elast-O-Kote 5, High Build Elastomeric Waterproofing; Kelly-Moore Paints, “1128 Kel Seal Terpolymer 100% Acrylic Elastomeric Coating”; Sherwin Williams, or equal.
      1) Color: Match Sherwin Williams’ “Messenger Bag.”

B. Wood Intended for Opaque Finish
0. Eggshell Finish: 2 finish coats of 100 percent exterior acrylic over a primer.
   a. Primer: As manufactured by Dunn Edwards, “INTER-KOTE Premium”; Kelly-Moore Paints; Sherwin Williams, or equal.
   b. Finish Coat(s): As manufactured by Dunn Edwards, “SPARTASHIELD”; Kelly-Moore Paints; Sherwin Williams, or equal.
      1) Color: As selected by the Architect from manufacturer’s full range.

C. Wood Intended for Transparent Finish
1. Waterborne Transparent Finish: 2 finish coats over a cleaner/neutralizer.
   a. Cleaner/Neutralizer: Apply prior to finish sanding.
      1) Product: As manufactured by Behr Products, “BEHR PREMIUM All-In-One Wood Cleaner No. 63”, or equal.
   b. First and Second Coats
      1) Waterproof penetrating sealer applied at thickness recommended by the manufacturer.

2. Product: As manufactured by Behr Products, “BEHR PREMIUM Transparent Weatherproofing All-In-One Wood Finish, No. 500 Natural”, or equal.

D. Galvanized Metal
1. Semi-Gloss Finish: 2 finish coats over primer. Primer is not required on shop-primed items. Reprime all areas where primer has been scratched, scraped, or removed.
   a. Pre-Treatment for New Galvanized Metal: As manufactured by Dunn Edwards, “Supreme Chemical Metal Clean & Etch, ME01”; Kelly-Moore Paints; Sherwin Williams, or equal.
   b. Primer: As manufactured by Dunn Edwards, “GALV-ALUM Premium, GAPR00”; Kelly-Moore Paints; Sherwin Williams, or equal.
c. Finish Coat(s): As manufactured by Dunn Edwards, “SYN-LUSTRO, W-9” or “SPARTASHIELD, SSHL50”; Kelly-Moore Paints; Sherwin Williams, or equal.

E. Ferrous Metal
   1. Semi-Gloss Finish: 2 finish coats over primer. Primer is not required on shop-primed items. Reprime all areas where primer has been scratched, scraped, or removed.
      a. Primer: As manufactured by Dunn Edwards, “BLOC-RUST Premium, BRPR00-1 Series”; Kelly-Moore Paints; Sherwin Williams, or equal.
      b. Finish Coat(s): As manufactured by Dunn Edwards, “SYN-LUSTRO, W-9” or “SPARTASHIELD, SSHL50”; Kelly-Moore Paints; Sherwin Williams, or equal.

3.4 INTERIOR PAINT SCHEDULE

A. Gypsum Board, Typical
   1. Eggshell Finish: 2 finish coats over a wall sealer.
      a. Wall Sealer: As manufactured by Dunn Edwards, “VINYLASTIC Select, VNSL00”; Kelly-Moore Paints; Sherwin Williams, or equal.
      b. Finish Coat(s): As manufactured by Dunn Edwards, “SPARTAWALL, SWLL30”; Kelly-Moore Paints; Sherwin Williams, or equal.
      a. Undercoater: As manufactured by Dunn Edwards, “INTER-KOTE, W6325”; Kelly-Moore Paints; Sherwin Williams, or equal.
      b. Finish Coat(s): As manufactured by Dunn Edwards, “SUPREMA, SPMA50” or “SPARTASHIELD, SSHL50”; Kelly-Moore Paints; Sherwin Williams, or equal.

B. Wood Intended for Opaque Finish
      a. Undercoater: As manufactured by Dunn Edwards, “INTER-KOTE, W6325”; Kelly-Moore Paints; Sherwin Williams, or equal.
      b. Finish Coat(s): As manufactured by Dunn Edwards, “SUPREMA, SPMA50” or “SPARTASHIELD, SSHL50”; Kelly-Moore Paints; Sherwin Williams, or equal.

C. Wood Intended for Transparent Finish
   1. Waterborne, Satin-Varnish Finish: 3 finish coats of a waterborne, clear-satin varnish over waterborne, interior wood stain.
      a. Stain Coat: Waterborne, interior wood stain applied at spreading rate recommended by the manufacturer; as manufactured by Kelly-Moore Paints, “2050”; Dunn Edwards; Sherwin Williams, or equal.
      b. First, Second and Third Finish Coats: Waterborne acrylic urethane varnish finish applied at spreading rate recommended by the manufacturer; as manufactured by Kelly-Moore Paints, “2097”; Dunn Edwards; Sherwin Williams, or equal.

D. Galvanized Metal
   1. Semi-Gloss Finish: 2 finish coats over primer. Primer is not required on shop-primed items. Reprime all areas where primer has been scratched, scraped, or removed.
a. Pre-Treatment for New Galvanized Metal: As manufactured by Dunn Edwards, “Supreme Chemical Metal Clean & Etch, ME01”; Kelly-Moore Paints; Sherwin Williams, or equal.

b. Primer: As manufactured by Dunn Edwards, “ULTRA-GRIP Premium, UGPR00”; Kelly-Moore Paints; Sherwin Williams, or equal.

c. Finish Coat(s): As manufactured by Dunn Edwards, “SYN-LUSTRO, W-9” or “SPARTASHIELD, SSHL50”; Kelly-Moore Paints; Sherwin Williams, or equal.

2. Epoxy Gloss Finish: 2 finish coats over a primer.

a. Primer
   1) 2-component, water reducible, epoxy-polyamide primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
   2) Product: Kelly-Moore Paints, “7126 Envira-Poxy”; Dunn Edwards; Sherwin Williams, or equal.

b. First and Second Coats
   1) Gloss, 2-component, water reducible epoxy-polyamide, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
   2) Product: Kelly-Moore Paints, “7100 Envira-Poxy”; Dunn Edwards; Sherwin Williams, or equal.

E. Ferrous Metal

1. Semi-Gloss Finish: 2 finish coats over primer. Primer is not required on shop-primed items. Reprime all areas where primer has been scratched, scraped, or removed.

a. Primer: As manufactured by Dunn Edwards, “BLOC-RUST Premium, BRPR00-1 Series”; Kelly-Moore Paints; Sherwin Williams, or equal.

b. Finish Coat(s): As manufactured by Dunn Edwards, “SYN-LUSTRO, W-9” or “SPARTASHIELD, SSHL50”; Kelly-Moore Paints; Sherwin Williams, or equal.

2. Epoxy Gloss Finish: 2 finish coats over a primer.

a. Primer
   1) 2-component, water reducible, epoxy-polyamide primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
   2) Product: Kelly-Moore Paints, “7126 Envira-Poxy”; Dunn Edwards; Sherwin Williams, or equal.

b. First and Second Coats
   1) Gloss, 2-component, water reducible epoxy-polyamide, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
   2) Product: Kelly-Moore Paints, “7100 Envira-Poxy”; Dunn Edwards; Sherwin Williams, or equal.

F. Spray-Foam Insulation Thermal Barrier Top Coating: Matte finish, 100 percent latex acrylic water-based paint; as manufactured by Sherwin Williams, “A100”, or as approved by thermal barrier manufacturer specified in Section 07 21 19.

END OF SECTION
SECTION 09 96 53
ELASTOMERIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and application of elastomeric coatings where indicated.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
   1. Section 09 90 00 - Painting and Coating: For finish painting.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials
   1. D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-
      Tension.
      Adhesion Testers.
      Materials.
   5. G152 - Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for
      Exposure of Nonmetallic Materials.

B. FM - Factory Mutual

C. FS - Federal Specifications
   1. TT-C-555B - Coating, Textured (For Interior and Exterior Masonry Surfaces).

D. UL - Underwriters Laboratories Inc.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements
   2. Tack Free Time: 6 hours at 73 degrees Fahrenheit, 50 percent relative humidity.
   3. Final Cure: Less than 24 hours.
   5. Tensile Properties (ASTM D412)
      a. 7 Day-Tensile Strength: 190 psi.
      b. Elongation at Break: 820 percent - 340 percent at 0 degrees Fahrenheit.
   6. Crack Bridging (at Minus 4 Degrees Fahrenheit)
      a. Static: 30 mils.
      b. Dynamic (Greater than 1000 Cycles): 12 mils.
7. Resistance to Wind Driven Rain (FS TT-C-555B): No passage of water through coating.
8. Weathering (ASTM G152): 10,000 hours excellent, no chalking or cracking.
9. Solids Content
   a. By Weight: 62 percent.
   b. By Volume: 50 percent.
10. Flame Spread and Smoke Development (ASTM E84), Class A Rating
    a. Flame Spread: 5.
    b. Smoke Development: 5.

### 1.4 SUBMITTALS

A. Product Data: For elastomeric coating system specified. Include primer.
   1. Material List: An inclusive list of each required coating material. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer’s catalog number and general classification.
   2. Manufacturer’s Information: Manufacturer’s technical information and instructions for handling, storing, and applying each coating material proposed for use.
   3. Certification by elastomeric coating manufacturer that products supplied comply with local regulations controlling use of VOCs.

B. Samples for Initial Selection: Manufacturer’s standard color chart for each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated to confirm selections.
   1. Submit four samples on rigid backing, 8 inches square.
   2. Step coats on samples to show each coat required for system.
   3. Label each coat of each sample.
   4. Label each sample for location and application area.

D. Qualification Data: For Applicator.

E. Product Test Reports: Based on evaluation of comprehensive tests by a qualified testing agency for each elastomeric coating material indicating compliance of elastomeric coatings with requirements based on comprehensive testing within the last 2 years of current product formulations.
   1. Material Certificates: In lieu of agency test reports, when permitted by the Architect, certificates signed by manufacturers certifying that each material complies with requirements specified.

### 1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed coating system applications similar in material and extent to those indicated for this Project with a record of successful in-service performance.

B. Adhesion Testing: Provide adhesion tests for elastomeric wall coating over elastomeric traffic coating prior to installation of final work. Provide the Architect and waterproofing Consultant with 1 week notice prior to adhesion tests. Perform the adhesion testing per ASTM D4541.
C. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution and to test adhesion to substrate.

1. District Representative will select one surface to represent surfaces and conditions for application of each paint system specified.
2. Final approval of color selections by District will be based on benchmark samples.
   a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by District at no added cost to District.
3. The mockup of coating installation prior to commencement of work can be combined with mockup for color selection, upon approval by District Representative.
4. Allow coating to cure a minimum of 4 days.
5. Provide minimum 72 hours notice to manufacturer’s representative, Architect, and District Representative to be present at inspection of mockup after sufficient curing time. In the presence of the manufacturer’s representative, Architect, and District Representative, perform tape adhesion tests to ensure sufficient bond of coating to substrate.
6. If inspection shows that sufficient adhesion has not been achieved, remove mockup and reiterate procedure until approved, at no additional cost to District.
7. Approved mockup may be incorporated into the work. Do not proceed with the work until the mockup is approved by the District.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Deliver materials to the Project site in manufacturer’s original, unopened packages and containers bearing the manufacturer’s name and label, and the following information:

1. Product name or title of material.
2. Manufacturer’s stock number and date of manufacture.
3. Contents by volume, for pigment and vehicle constituents.
4. Thinning instructions (if permitted).
5. Application instructions.
6. Color name and number.
7. Handling instructions and precautions.
8. VOC content.

B. Storage and Protection

1. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees Fahrenheit. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
2. Take necessary measures to ensure workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.7 PROJECT CONDITIONS

A. Temperature Conditions: Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 90 degrees Fahrenheit, unless otherwise permitted by manufacturer’s written instructions.
B. Weather Conditions: Do not apply coatings in rain, fog, or mist; when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees Fahrenheit above the dew point; or to damp or wet surfaces.
   1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before starting or continuing coating operation.

1.8 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the District of other rights the District may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Elastomeric Coating Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace elastomeric coatings that fail within the specified warranty period. Failures include, but are not limited to, water penetration through the coating.
   1. Warranty Period: 5 years from the date of Substantial Completion.

1.9 MAINTENANCE

A. Extra Materials: Furnish extra elastomeric coating materials from the same production run as the materials applied in quantities described below. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the District.
   1. Quantity: Furnish the District with 1 extra case of each color of elastomeric coating materials applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Sika Corporation; Dow Corning, or equal.

2.2 ELASTOMERIC COATING MATERIALS

A. General
   1. Material Compatibility: Provide crack fillers, primers, elastomeric finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   2. Material Quality: Provide the manufacturer’s best-quality elastomeric coating material complying with requirements of FS TT-C-555. Material containers not displaying manufacturer’s product identification are not acceptable.
   3. Colors and Textures: Provide color and texture selections made by the Architect from manufacturer’s full range of colors for elastomeric coating systems.

B. Crack Filler: Factory-formulated acrylic emulsion compatible with substrate and finish coat materials indicated, as manufactured by Sika Corporation, “Sikagard Elastic Base Coat”; Dow Corning, or equal.
C. Primer: Water-based, acrylic, as manufactured by Sika Corporation, “Sikagard 552W Primer” or “SikaLatex R”; Dow Corning, or equal.

D. Finish Coating: 100 percent acrylic emulsion, water vapor permeable, as manufactured by Sika Corporation, “Sikagard 550W Elastocolor”; Dow Corning, or equal.
   1. Color: As selected by the Architect from manufacturer’s full range of standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with the applicator present, under which elastomeric coating systems will be applied for compliance with application requirements. Surfaces to receive elastomeric coatings must be thoroughly dry before coatings are applied.
   1. Notify the Architect in writing of anticipated problems using coatings specified with substrates primed by others.
   2. Begin application only after unsatisfactory conditions have been corrected and surfaces to receive coating are thoroughly dry.
   3. Start of coating within a particular area will be construed as the applicator’s acceptance of surface conditions.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   1. After completing coating operations in each area, reinstall items removed, using workers skilled in trades involved.

B. Cleaning: Before applying coatings or other surface treatments, clean substrates of substances that could impair bond of coating systems. Remove oil and grease before cleaning.
   1. Schedule cleaning and coating application so dust and other contaminants will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer’s written instructions for the particular substrate conditions and as specified.
   1. Cementitious Surfaces: Prepare concrete and similar surfaces to receive elastomeric coatings. Remove efflorescence, chalk, dust, dirt, release agents, grease, oils, and similar conditions by water blasting followed by a clear water rinse.
      a. Remove mildew and neutralize surfaces according to manufacturer’s written recommendations before patching materials are applied.
      b. Roughen as required to remove glaze. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
      c. If hardeners or sealers have been used to improve concrete curing, use mechanical methods for surface preparation.
      d. Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. Do not apply coatings over surfaces where moisture content exceeds that permitted in manufacturer’s written instructions.
2. Crack Repair: Fill cracks according to manufacturer’s written recommendations before coating surfaces.

3. Deep Hairline Cracks: Remove dust and dirt from around cracks. Remove mildew by sterilizing before filling. Apply manufacturer’s recommended primer to cracks before patching. If shrinkage occurs after applying crack filler, apply additional filler material to cracks before initially applying elastomeric coatings.
   a. Cracks up to 1/16-Inch: Clean surface around cracks. Apply primer penetrating cracks as deeply as possible, overflowing crack 2 inches on each side. When primer is dry, apply manufacturer’s recommended sealant, forced well into cracks using a brush, putty knife, or trowel. Smooth edges around cracks over primed area. Allow for sealant shrinkage when applying.
   b. Cracks up to 3/8-Inch: Open cracks to 1/4-inch to 3/8-inch wide and 1/8-inch deep. Clean cracks and surrounding area removing dust, dirt, and other impurities. Apply primer recommended by manufacturer with a brush to obtain uniform coverage and spread approximately 2 inches on each side of cracks. Fill cracks with manufacturer’s recommended crack filler applied with a putty knife or trowel, and allow for shrinkage. If excessive shrinkage occurs, reapply crack filler.

4. Coated Elastomeric Surfaces: Allow (polyurethane) elastomeric traffic coating to fully cure prior to application of wall coating.

D. Material Preparation: Mix and prepare materials according to coating manufacturer’s written instructions.
   1. Stir materials before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film that may form into material. Remove film and, if necessary, strain coating material before using.
   2. If manufacturer permits thinning, use only thinners recommended by manufacturer, and only within limits recommended by manufacturer.

3.3 APPLICATION

A. General: Apply elastomeric coatings to exposed surfaces indicated, according to manufacturer’s written instructions.

B. Labels: Do not paint over UL, FM, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

C. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
   2. If undercoats or other conditions show through final coat, apply additional coats until coating film is of uniform finish, color, and appearance. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
   3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat does not cause undercoat to lift or lose adhesion.
D. Application Procedures: Apply elastomeric coatings by brush, roller, or spray according to manufacturer’s written instructions.
1. Brushes: Use brushes best suited for material being applied.
2. Rollers: Use professional-quality quick-release rollers of carpet, velvet back, or high-pile sheep’s wool covers with a 1 inch to 1-1/4 inch nap as recommended by the manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for material and texture required.
4. Minimum Coating Thickness: Apply each material no thinner than manufacturer’s recommended spreading rate. Provide total dry film thickness as recommended by the manufacturer.
5. Wherever spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment, building up film thickness of 2 coats in 1 pass.

E. Prime Coats: If recommended by the manufacturer, apply a primer to material being coated before applying finish coats.

F. Brush Application: Brush out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

G. Roller Application: Keep the cover wet at all times; do not dry roll. Work in sections. Lay on required amount of material, working material into grooves and rough areas; then level material, working it into surface.

H. Spray Application: Use spray equipment for application only when permitted by manufacturer’s written recommendations and authorities having jurisdiction.

I. Completed Work: Match approved samples for color, texture, and coverage; tint to match color of paint for exterior walls. Remove, refinish, or recoat work not complying with specified requirements.

3.4 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from the Project site.
1. After completing coating work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping, or other methods, being careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades from damage whether being coated or not. Correct damage by cleaning, repairing, replacing, and recoating as approved by the Architect. Leave in an undamaged condition.
B. Provide “Wet Paint” signs to protect newly coated finishes. Remove temporary protective wrappings provided by others to protect their work after completing coating operations.

1. After construction activities of other trades are complete, touch up and restore damaged or defaced coated surfaces.

END OF SECTION
SECTION 09 97 25

VAPOR EMISSION TREATMENT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Vapor control barrier applied to new concrete slabs at interior areas scheduled to receive moisture sensitive floor coverings not limited to resilient and carpet, as required.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 09 65 00 - Resilient Flooring: Provision of resilient flooring.

1.2 REFERENCES


1.3 SUBMITTALS

A. Product Data: Provide the following:
   1. Descriptive Literature: Materials and accessories.
   2. Project References: Similar project completed within 5 years.
   3. Installer: Direct factory/manufacturer employed personnel certificates for each installer.
   4. Field Documents: Manufacturer shall provide written acceptance of on-site conditions, concrete mix design, admixtures, concrete salts, sub-slab vapor retarder, and surface applied contaminants, prior to barrier installations. No exceptions.

B. Quality Assurance Submittals: Provide the following independent test results indicating compliance:
   1. ASTM C309 Curing Requirements.
   2. ASTM D1308 Alkali Resistance.
   3. ASTM C1315 Curing/Sealing Requirements.
4. ASTM C156 Water Retention Level.
5. ASTM D4541 Floor Adhesion Testing.

1.4 QUALITY ASSURANCE

A. Qualifications
1. Manufacturer: Manufacturing history of 10 years and product liability insurance in the amount of $1,000,000 per occurrence.
2. Installer: Manufacturer direct installations by factory employed personnel. No exceptions.

1.5 WARRANTY

A. Manufacturer’s Warranty: Written warranty, signed by manufacturer, agreeing to replace water system that does not comply with requirements or that does not remain watertight during specified warranty period.

B. Warranty shall not exclude concrete salts, admixtures, surface contaminates, or resin and silicate surface treatments. Installations on slab surfaces deems acceptance of on-site conditions. Manufacturer is responsible for complete review of concrete mix designs, admixtures, sub-slab vapor retarder installed, and curing methods, for written acceptance prior to installation.

C. Workmanship and Materials Warranty
1. Manufacturing Defects Warranty Period: 10 years.
2. Installation Defects Warranty: 10 years.
3. Warranty Covering Improper Installations: 10 years.
4. Moisture and Alkalinity Damage to Flooring: 10 years.
5. Manufacturer’s limited warranty shall cover 100 percent of the cost to repair or replace floor coverings damaged by moisture and alkalinity. Coverage shall include
   a. Installed epoxy based vapor/alkalinity barrier.
   b. Floor covering systems or resinous materials.
   c. Adhesives, patching materials and installation accessories.
   d. All installation labor charges involved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS


2.2 MATERIALS

A. At New Concrete: Provide vapor/alkalinity barrier, 36 percent modified resin based penetrating barrier, containing specifically formulated chemicals and resins to saturate slab surfaces for seamless vapor/alkali barrier to protect floor coverings from damage.
B. Materials containing water based solutions of sodium, potassium, and lithium silicates do not meet performance levels specified in this Section. Silicate based solutions are chemically reactive and do not meet the intent of ASTM C309. See ASTM documents for verification.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify that sub-slab vapor retarder meets ASTM E1745 Class A; the concrete water-to-cement ratio maximum of 0.45; sub-soil over vapor retarder is not rained on or saturated, and concrete is not poured during a day of rain.

B. Manufacturer shall accept conditions in writing prior to installation.

3.2 PREPARATION

A. General: Coordinate work with work specified under other sections to ensure proper and adequate interface of work. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work.

B. Concrete Substrates: Apply when concrete is not marred by walking workman. Freshly poured concrete shall be free of surface contaminants, rain, and other sealing/curing materials.

3.3 APPLICATION

A. At New Concrete
1. General: Apply material while concrete is still wet to produce a uniform, monolithic wearing surface.
2. Coordinate application of components to provide optimum adhesion to substrate.
3. Begin application by manufacturer employed personnel or factory installer when on-site conditions are accepted.
4. Apply system coat(s) in thickness to achieve maximum performance.
5. Barrier Application: Coverage rate for system shall be based on the surface texture and porosity of the substrates. Maximum cure time of 12 hours. Allow walking traffic in 4 hours.

3.4 FIELD QUALITY CONTROL

A. Validation Testing: Perform post installation testing at 1 calcium chloride test per 1,000 square feet. Interior temperature and humidity to be similar during the District’s occupancy.

B. Reapply materials in areas above flooring manufacturer’s limits, prior to floor covering installations at no additional charge to the District.
3.5 PROTECTION

A. Protection: Protect installations during specified cure periods from any kind of traffic, topical water, and contaminants.

END OF SECTION
SECTION 10 11 00
VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Markerboards.
   2. Tackboards with backing and trim.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 05 45 00 - Metal Support Assemblies: Provision of metal support assemblies.
   2. Section 09 29 00 - Gypsum Board: Provision of gypsum board surfaces.

1.2 REFERENCES

A. AAMA - American Architectural Manufacturers Association
   1. 603.8 - Voluntary Performance Requirements and Test procedures for Pigmented Organic Coatings on Extruded Aluminum.

B. APA - American Plywood Association

C. NAAMM - National Association Architectural Metal Manufacturers
   1. MFM - Metal Finishes Manual for Architectural and Metal Products.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer’s product data for markerboards and tackboards.

B. Shop Drawings: Provide shop drawings for each type of markerboard and tackboard required. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

C. Samples: Provide the following samples of each product for initial selection of colors, patterns, and textures, as required, and for verification of compliance with requirements indicated.
   1. Porcelain Enamel Markerboard: Manufacturer’s color charts consisting of actual sections of porcelain enamel finish showing the full range of colors available for each type of markerboard required.
   2. Tackboard: Manufacturer’s standard color samples.
   3. Aluminum Trim and Accessories: Samples of each finish type and color, on 6 inch long sections of extrusions and not less than 4 inch squares of sheet or plate, showing the full range of colors available.
D. Manufacturer’s Installation Data: Manufacturer’s recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.4 QUALITY ASSURANCE

A. The Drawings indicate size, profiles, and dimensional requirements of visual display boards and are based on the specific type and model indicated. Other visual display boards having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept or intended performance as judged by the Architect. The burden of proof of equality is on the proposer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.
1. Allow for trimming and fitting wherever taking field measurements before fabrication might delay the Work.

1.6 WARRANTY

A. Porcelain Enamel Markerboard Warranty: Furnish the manufacturer’s written warranty, agreeing to replace porcelain enamel markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking, provided the manufacturer’s instructions with regard to handling, installation, protection, and maintenance have been followed.
1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers

2.2 MATERIALS

A. Porcelain Enamel Markerboards: Provide balanced, high pressure laminated porcelain enamel markerboards of 3-ply construction consisting of face sheet, core material, and backing.
1. Surface: Provide face sheet of low gloss, magnetic, 24 gauge vitracite face over backing. Coat the exposed face and exposed edges with a 3-coat process consisting of primer, ground coat, and color cover. Fuse cover and ground coats to steel at the manufacturer’s standard firing temperatures, but not less than 1,200 degrees Fahrenheit.
   a. Size: As indicated.
2. Chalktray: Continuous, solid extrusion-type aluminum chalktray, triangular profile, with ribbed section and formed aluminum end caps.
3. Backing: 1/4-inch thick interior type standard underlayment bearing trademark of APA or high quality hardboard as standard with reviewed manufacturer.
5. Adhesive: As recommended by markerboard manufacturer.

B. Tackboard/Bulletin Board
1. Surface: Linseed oil, granulated cork, resin binders, and dry pigments are mixed and calendared onto a natural burlap backing and laminated to a 1/4-inch thick hardboard backing.
   a. Color: As selected by the Architect from manufacturer’s full range.
2. Frame: Clear anodized aluminum, profile as indicated.
3. Size: As indicated.

2.3 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.

B. Where the size of boards or other conditions exist that require support in addition to the normal trim, provide structural supports or modify the trim as indicated or as selected by the Architect from the manufacturer’s standard structural support accessories to suit the condition indicated.

C. Field-Applied Trim: Provide the manufacturer’s standard slip-on aluminum trim, to eliminate grounds.

2.4 FABRICATION

A. Porcelain Enamel Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer’s recommended flexible, waterproof adhesive.

B. Tackboards
1. Cork: Manufacturer’s standard.
2. Fiberboard: Manufacturer’s standard, exterior grade where applicable.
3. Adhesives: As recommended by reviewed tackboard manufacturer.

C. Assembly: Provide factory-assembled visual display units, except where field-assembled units are required.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of the surface, as acceptable to the Architect.
2. Provide the manufacturer’s standard vertical joint system between abutting sections of visual display surfaces.
2.5 METAL FINISHES

A. General: Comply with NAAMM’s MFM for recommendations relative to application and designations of finishes.

B. Organic Coating: Thermosetting modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with minimum dry film thickness of 1.5 mils, medium gloss.

C. Color: As selected by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Markerboards and Tackboard
   1. Deliver factory-built visual display surfaces completely assembled in 1 piece without joints, wherever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.
   2. Install units in locations and at mounting heights indicated and in accordance with the manufacturer’s instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.
   3. Coordinate job-site assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.2 ADJUST AND CLEAN

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units in accordance with the manufacturer’s instructions. Break in visual display surfaces only as recommended by the manufacturer.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Signage as indicated on the Drawings.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. ADA - Americans with Disabilities Act

B. CBC - California Building Code, 2016 Edition

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Design all signs as required by ADA and CBC - Title 24 and in accordance with District’s signage standards using Diablo Valley College Campus Wayfinding Sign System V1.0. The District’s signage standards are available for review.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with ADA and CBC requirements for signage, to include Braille.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s product data describing materials and signs.

B. Shop Drawings
   1. Provide shop drawings showing construction details for approval before proceeding with fabrication. Include full size details of exposed edges, joints between materials, hanging, hinging and locking systems and any other details which would affect sign appearance.
   2. Fasteners: Detail methods of fastenings and provide exact specifications for all fasteners noted on shop drawings.
   3. Artwork: Submit full size patterns or prints of typical copy layouts and/or graphic elements to be applied on signs. Using layouts on the Drawings as a guide, optically enlarge and hand correct images before submitting to the Architect for approval before fabrication.
   4. Sign Location: Provide Graphic Schedule and location plans to identify and locate all signs. Item numbers listed in the Graphic Schedule shall be found on location plans and shall identify locations of specific sign items.
C. Samples
1. On 6-inch by 6-inch pieces of actual sign materials, submit to the Architect for review and approval, 3 samples of painted and graphic finishes, in each material, color and finish, with texture to simulate actual conditions.
2. Provide samples of simulated signs with color, text, and type as indicated on the Drawings, including classroom name/number sign, room identification sign, tactile exit sign, and restroom sign. If approved, sample(s) can be used on site.
3. Provide listing of the material and application for each coat of each finish sample.
4. Be prepared to resubmit each sample as requested until required sheen, color and texture are approved.
5. Fasteners: Submit 1 sample of all fasteners and hardware for approval.
6. Paint: Submit 3 color and finish samples of all paints and finishes for approval prior to fabrication.

D. Operation and Maintenance: Provide the District’s Project Manager with proper cleaning instructions required for continued maintenance of signs.

1.6 QUALITY ASSURANCE

A. Pre-Installation Conferences: Sign locations shown on the location plans are for general information only. Prior to installation and as required, arrange meetings with the Architect at the site for final location for all sign items.

B. Signage Approvals: Final room names and numbering shall be reviewed by the College prior to fabrication. Text and overall size of sign as affected by text is subject to change with no additional cost to the District.

1.7 WARRANTY

A. All paints and finishes shall be warranted against failure (color fading, UV damage, cracking, peeling, blistering, or any other defect for at least 5 years from date of District’s acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: ASI Sign Systems, Inc.; Superior Sign Systems; Vomar Products, Inc., or equal.

2.2 MATERIALS

A. Metal Signage
1. Letterforms at Exterior Building Signage: Minimum 12-inch stainless steel with brushed faces and finished returns. See Drawings for exact locations and sizes. Where required, letters shall be mounted on rail or bracket and wall-mounted.
2. Zinc Signs: 1/8-inch laminated to a substrate for 1/4-inch thickness. See Drawings for design.
3. Aluminum Signs: 1/8-inch with painted text. See Drawings for design.
4. **Aluminum Letters:** Minimum 3/8-inch thick, shall be set in font indicated on the Drawings and mounted on rail and bracket as indicated. Letters shall come pre-assembled with rails/brackets to ensure fit.

B. **Vinyl Film:** Opaque reflective or non-reflective vinyl film as indicated, 0.0355-inch minimum thickness, with pressure sensitive permanent adhesive backing; as manufactured by 3M, “Scotchcal”, or equal.
   1. All colors shall be integral and not surface applied except where custom color(s) are specified in the Drawings. All custom colors shall be flood coated on white vinyl.

C. **Mounting Tape:** Double-sided vinyl foam tape, as manufactured by 3M, “VHB”; Essentra Specialty Tapes; Uline, or equal. Provide silicone adhesive for attachment to wall surface.

D. **Fasteners:** Where fasteners are indicated or required, use exposed “torx type” tamper-proof security screws.

2.3 **FABRICATION, GENERAL**

A. **Metals:** Shall be free of defects impairing strength, durability, or appearance. Unless otherwise indicated, all metals shall be the best commercial quality for the purposes specified, and all visible seams shall be continuously welded, filled, and ground smooth. Any and all sheet metal shall have brake formed edges with radii not greater than sheet thickness. All metals shall be treated to prevent corrosion and staining of other finishes.

B. **Graphic Content and Style:** Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

C. **Braille Symbols:** California Contracted Grade 2 Braille shall be used wherever Braille symbols are specifically required in other portions of these standards. Dots shall be 1/10-inch on centers in each cell with 2/10-inch space between cells. Dots shall be raised a minimum of 1/40-inch above the background.
   1. Provide men/women restroom door and wall signs, exit, exit route, and exit stair down signs, and room identification signs in Braille as indicated.

D. **Fasteners:** Unless otherwise indicated, exposed fasteners shall be corrosion- and oxidation-resistant, tamper-proof, and painted to match adjacent surfaces. Concealed fasteners shall be corrosion- and oxidation-resistant to prevent staining of other surfaces.

2.4 **FINISHES**

A. **General:** All paints and finishes shall match exactly the color, finish, texture, and manufacturer indicated. All pretreats, primers, coatings, finishes, paints, etc. shall be applied in strict conformance with the manufacturer’s specifications and recommendations to ensure the highest possible level of UV light resistance, weatherability, and overall longevity for both the materials indicated and any and all environmental conditions which exist at the final install locations.

B. **Colors:** For exposed sign material that requires applied colors and other characteristics related to appearance, see Drawings.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the substrate and conditions in which the work is to be installed. Correct all unsatisfactory substrate and conditions prior to start of installation.

3.2 INSTALLATION

A. General
   1. Install signage in neat and proper manner.
   2. Install sign items, including all components, in accordance with reviewed Graphic Schedule at locations shown.
   3. Install signs properly aligned, level and true to line and dimension.

B. Install with reviewed manufacturer’s adhesive or mechanical fasteners after application of finish painting at heights noted.

3.3 SCHEDULE

A. Signage font, size, color and background color as indicated on the Drawings.

B. Signage shall be in compliance with CBC.

END OF SECTION
SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Floor mounted, overhead braced solid phenolic core and melamine-faced toilet partition at ambulatory stall.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section

1.2 REFERENCES

A. ADA - Americans with Disabilities Act

B. ASTM - American Society for Testing and Materials

C. CBC - California Building Code, 2016 Edition

D. ICC - International Code Council

E. NFPA - National Fire Protection Association

F. UL - Underwriters Laboratories Inc.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Toilet compartments shall meet the following requirements:
   1. Graffiti Resistance: Partition material shall have the following graffiti removal characteristics when tested in accordance with ASTM D6578:
      a. Cleanability: 5 required staining agents shall be cleaned off material.
   2. Scratch Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2197:
      a. Scratch Resistance: Maximum load value shall exceed 10 kilograms.
   3. Impact Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D279:
      a. Impact Resistance: Maximum impact force value shall exceed 30 inch-lbs.
4. Fire Resistance: Partition material shall comply with the following requirements when tested in accordance with ASTM E84:
   a. Smoke Developed Index: Not to exceed 450.
   b. Flame Spread Index: Not to exceed 75.
   c. Material Fire Ratings
      1) NFPA Class B.
      2) ICC Class B.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for materials, fabrication, and installation including catalog cuts of anchors, hardware, fastenings, and accessories.

B. Shop Drawings: Submit shop drawings for fabrication and erection of toilet compartment assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Install fire rated ceiling systems in accordance with CBC and UL FRD listing and requirements of agency having jurisdiction.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on shop drawings.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS


2.2 MATERIALS

A. General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.

B. Partitions: Solid phenolic material constructed of solidly fused plastic laminate with matte finish melamine surfaces, colored face sheets, and black phenolic-resin core that are integrally bonded. Edges shall be black; brown edges shall not be acceptable.
C. Pilaster Shoes and Sleeves (Caps): Manufacturer’s standard stainless steel, Type 304.

D. Full Height (Continuous) Brackets: Manufacturer’s standard design for attaching panels to walls and pilasters with stainless steel, Type 304, brackets.

E. Hardware and Accessories: Manufacturer’s standard design, heavy duty operating hardware and accessories of stainless steel, Type 304. Provide slide bolts at all stalls. Mount coat hooks and bumpers 48 inches above the floor.

F. Overhead Bracing: Manufacturer’s standard continuous, extruded aluminum head rail with antigrip profile in manufacturer’s standard finish.

G. Anchorages and Fasteners: Manufacturer’s standard theft-proof exposed fasteners finished to match hardware.

2.3 FABRICATION

A. General: Provide standard doors, panels, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

B. Provide manufacturer’s standard corrosion resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Accessible Door Dimensions: Furnish 32-inch wide (clear opening) out-swinging doors at front-entry accessible stalls and 34-inch wide (clear opening) out-swinging doors at side-entry accessible stalls.

D. Hardware: Furnish hardware for each compartment to comply with ADA for accessibility and as follows:
   1. Hinges: Cutout inset type, adjustable to hold door open at any angle up to 90 degrees. Provide gravity type, spring-action cam type, or concealed torsion rod type to suit manufacturer’s standards.
   2. Latch and Keeper: Manufacturer’s standard surface mounted latch unit, designed for accessibility, with combination rubber-faced door strike and keeper.
   4. Door Pull: Provide “U” pulls on both faces of accessible compartment doors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer’s recommended procedures and written installation instructions and sequence. Install compartment units rigid, straight, plumb, and level. Provide clearances of not more than 1/2-inch between pilasters and panels, and not more than 1 inch between panels and walls. Secure units in position with manufacturer’s recommended anchoring devices.
B. Secure pilasters to floor and level, plumb and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.2 ADJUST AND CLEAN

A. Hardware Adjustment: Adjust and lubricate hardware for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors (and entrance swing doors) to return to fully closed position.

B. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Stainless steel corner guards at Café, Servery, and Kitchen.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

1.3 SUBMITTALS

A. Product Data: Submit product data for each wall surface protection system component and installation accessory required, including installation methods for each type of substrate. Provide written data on each required component including physical characteristics.

B. Shop Drawings: Submit shop drawings showing locations, extent, and installation details of corner guards. Show methods of attachment to adjoining construction.

C. Contract Closeout Submittals: Submit maintenance data for wall surface protection system components for inclusion in the operating and maintenance manuals.

1.4 MAINTENANCE

A. Maintenance Instructions: Provide the manufacturer’s instructions for maintenance of installed work. Include recommended methods and frequency for maintaining optimum condition under anticipated traffic and use conditions. Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

B. Extra Materials: After completion of work, deliver not less than 2 percent of each type, color, and pattern of wall surface protection materials and components. Include accessory components as required. Replacement materials shall be from the same production run as materials installed. Package replacement materials with protective covering, identified with appropriate labels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 MATERIALS

A. Stainless Steel Sheet: Type 304, minimum 0.0500-inch thick (16 gauge), ASTM A240.
   1. Finish: Directional satin, No. 4.

B. Fasteners: Provide concealed noncorrosive metal screws, bolts, and other fasteners compatible with stainless steel components, hardware, anchors, and other items being fastened.

2.3 CORNER GUARDS

A. Stainless Steel Corner Guards: Provide surface mounted, stainless steel corner guard assembly, 2 inches by 2 inches by single length as indicated, with 1/8-inch radius corner.
   1. Provide corner guards at outside corner of gypsum board walls along typical corridors at height as indicated. Extend corner guards full height, unless otherwise indicated.

2.4 FABRICATION

A. General: Fabricate wall surface protection systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thicknesses of components.

B. Preassemble components in the shop to the greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of evidence of wrinkling, chipping, uneven coloration, dents, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

D. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnection of members to other construction.

E. Fabricate anchoring devices to be capable of withstanding imposed loads. Coordinate anchoring devices with the supporting structure.

F. Stainless Steel Corner Guards: Fabricate corner guards to comply with requirements indicated for design, dimensions, detail, finish, and member sizes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install wall surface protection units plumb, level, and true to line without distortions.
   1. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.

B. Stainless Steel Corner Guards: Mount with premium adhesive in accordance with manufacturer’s written instructions.
3.2 CLEANING

A. General: Immediately upon completion of installation, clean metal components in accordance with the manufacturer’s recommendations.

B. Remove excess adhesive using methods and materials recommended by manufacturer.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. New toilet accessories, including backing plates for grab bars.
   2. Remounting of existing grab bars and associated backing.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 05 45 00 - Metal Support Assemblies: Provision of metal support assemblies.

1.2 REFERENCES

A. ADA - Americans with Disabilities Act
B. AISI - American Iron and Steel Institute
C. ASTM - American Society for Testing and Materials
   2. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
D. CBC - California Building Code, 2016 Edition

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Comply with Contra Costa College Campus guidelines.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gauges, profiles, mounting method, specified options, and finishes.
B. Shop Drawings: Submit setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.

C. Contract Closeout Submittals: Submit maintenance instructions including replaceable parts and service recommendations.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements
1. Grab Bars and Fasteners: Strength of grab bars, fasteners and mounting devices shall comply with CBC Section 1115B.8 and ADA requirements.
2. Grab Bar Surfaces: Conform to CBC Section 1115B.8.4.
4. Operating Pressure for Soap Dispensers: Comply with ADA.

B. Inserts and Anchorages: Furnish accessory manufacturers’ standard concealed inserts and anchoring devices. Coordinate delivery with other work to avoid delay.

1.6 PROJECT CONDITIONS

A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Bobrick Washroom Equipment, Inc.; American Specialties, Inc.; Kimberly-Clark Professional; Uline, or equal.

2.2 MATERIALS

A. Materials - General: Fabricate toilet accessory items form the following materials and according to requirements specified for individual accessory items.
1. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gauge minimum thickness, unless otherwise indicated.
2. Sheet Steel: Cold-rolled, commercial quality, 20 gauge minimum thickness, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.
6. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.
7. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply. Provide a minimum of 6 keys to the District.

2.3 ACCESSORIES

A. Provide the following accessories:
2. Grab Bar Around Drinking Fountain: Surface-mounted wall-to-floor, 18 inches wide by 33 inches tall, 1-1/2 inches diameter with snap on flanges, 304 Type stainless steel, smooth or peened finish as selected by the Architect, as manufactured by American Specialties, Inc., “Type 75”, or equal.
3. Toilet Paper Dispenser: Match existing at East 177 and 178 or provide plastic, double roll style as manufactured by Uline, “H-1347”; Kimberly-Clark Professional, “Model 09551”, or equal.

B. Mounting Plates: Non-corrosive material. Provide as required.

2.4 FABRICATION

A. General: Only a maximum 1-1/2 inch diameter, unobtrusive stamped manufacturer logo, as approved by the Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer’s name and product model number.

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install toilet accessory units according to manufacturer’s instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer’s instructions for type of substrate involved.

C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F446.
3.2 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces strictly according to manufacturer’s recommendations after removing temporary labels and protective coatings.

END OF SECTION
SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Fire extinguishers complete with cabinets.
B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES
A. NAAMM - National Association of Architectural Metal Manufacturers
   1. MFM - Metal Finishes Manual for Architectural and Metal Products.
B. SSPC - The Society for Protective Coatings
   1. SP 1 - Surface Preparation Specification No. 1: Solvent Cleaning.
   2. SP 5 - Surface Preparation Specification No. 5: White Metal Blast Cleaning.
   3. SP 8 - Surface Preparation Specification No. 8: Pickling.
C. UL - Underwriters Laboratories Inc.

1.3 SUBMITTALS
A. Product Data: Submit manufacturer’s product data for cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.
B. Samples: Submit samples for initial selection purposes in the form of manufacturer’s color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of cabinet finish indicated or exposed to view.
C. Obtain Project Fire Inspector’s approval of cabinet and extinguisher model prior to purchase.

1.4 QUALITY ASSURANCE
A. Single-Source Responsibility: Obtain extinguishers and cabinets from one source from a single manufacturer.
B. UL Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating, and classification of extinguisher.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Potter Roemer; Larsen’s Manufacturing Co.; J. L. Industries, or equal.

2.2 MATERIALS

A. Fire Extinguishers
1. Typical: Multipurpose under pressure, dry chemical type bearing UL rating of 3-A:40-B:C, 5 pounds nominal capacity, in enameled steel container.
2. Kitchen: FE/FEC, minimum 1.5 gallon or 6 liter capacity, Type K.

B. Cabinets
1. Semi-recessed, 1-piece steel construction with 18 gauge steel box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
2. Provide reviewed manufacturer’s stainless steel door handles.
3. Door Style: Manufacturer’s door with glass view panel.

C. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER red lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.

2.3 FINISHES FOR CABINETS, GENERAL

A. Comply with NAAMM’s MFM for recommendations relative to applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying temporary strippable protective covering prior to shipping.

2.4 STEEL CABINET FINISHES

A. Surface Preparation: Solvent-clean surfaces complying with SSPC SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC SP 5 or SSPC SP 8.

B. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately following surface preparation and pretreatment.
1. Shop Primer: Manufacturer’s or fabricator’s standard fast-curing, lead-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
C. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer’s standard 2 coat baked enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer’s instructions for applying and baking to achieve a minimum dry film thickness of 2.0 mils.

1. Color and Gloss: As selected by the Architect from manufacturer’s standard choices for color and gloss. Paint the following:
   a. Exterior of cabinet, except for those surfaces indicated to receive another finish.
   b. Interior of cabinet.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for thickness and framing for cabinets to verify cabinet depth and mounting prior to cabinet installation.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Follow manufacturer’s printed instructions for installation.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities.
   1. Fasten mounting brackets and cabinets to structure, square and plumb.

END OF SECTION
SECTION 10 56 13

METAL STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Metal storage shelving units.
   2. New cantilever fixed library shelving units.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section
   1. Section 05 45 00 - Metal Support Assemblies: Provision of metal support assemblies.

1.2 REFERENCES

A. ISO - International Organization for Standardization

1.3 SYSTEM DESCRIPTION

A. Performance Requirement: Provide fixed shelving capable of withstanding the effects of earthquake motions determined according to the building codes.

1.4 SUBMITTALS

A. Shop Drawings: Show installation details for metal shelving, including upright-to-shelf/arm connections, lateral bracing, and attachments to other work. Include plans, elevations, sections, details, and relationship to other work.

PART 2 - PRODUCTS

2.1 SHELVING UNITS

A. Metal Storage Shelving: Factory-formed, field-assembled, freestanding, post-and-shelf metal storage shelving system; designed for shelves to span between and be supported by corner posts, with shelves adjustable over the entire height of shelving unit. Provide fixed top and bottom shelves, adjustable intermediate shelves, and accessories indicated.

1. Posts: Fabricated from 18 gauge, cold-rolled steel, ASTM A1008; in manufacturer’s standard shape with perforations at 1-1/2 inches on center to receive shelf-to-post connectors.

2. Heavy-Duty Shelves: Plain, fabricated from same material and with same finish as posts.

3. Shelf-to-Post Connectors: Manufacturer’s standard 11 gauge connectors.

4. Provide front bases, closed tee uprights, and closed angle uprights.

5. Dimensions: 36 inches to 48 inches wide by 24 inches deep; height as indicated.

6. Finish: Manufacturer’s standard.

7. Product: As manufactured by Spacesaver, or equal.
B. Cantilever Fixed Library Shelving
   1. Seismic Welded Frame: Single face shelf, 84 inches high, 10 inches shelf, 12 inches base depth with closed base shelves; adjustable shelves with low back; with wall clips.
   2. Provide canopy bracket for wood veneer tops.
   3. Provide mounting brackets for wood veneer end panels, steel closure backs.

2.2 FINISHES

A. Finishes shall be the finest of their respective kinds and those best adapted to the construction for which they are employed to meet ISO 9001:2000 quality standards. All steel shall be the best mild, cold rolled, pickled, and double annealed, free from scale and buckle. All plating used on exposed parts shall be metallic furniture stock. All gauges are U.S. standard. The design of all parts shall be such that the completed installation shall present a neat and finished appearance and shall be free from exposed sharp edges or projections. All other special materials shall be as hereinafter specified.

B. All components shall be painted with an electrostatically applied powder coat finish. All steel parts shall be made smooth and thoroughly cleaned by a process of completely washing in a phosphatizing solution to insure removal of oil, grease, or other foreign material which in any way would interfere with the adhesion of the priming coat. Following the cleaning process, all parts shall be coated by spraying, making certain every part is thoroughly and completely covered with fine powder coat, and baked to the paint manufacturer’s recommendation. The finish for powder coat shall be medium gloss, giving a reading of 50 to 60 degrees on a standard gloss meter and must be capable of withstanding severe hammer and bending test without flaking. The finish for epoxy-polyester hybrid powder coat shall be a minimum 1.2 mil thickness capable of resisting acetic acid, household ammonia, 10 percent lye, alcohol, salt spray, abrasion and printing, and all normal usage resistant requirements of a good finish. In addition, powder coat shall not be off gassing to prevent deterioration of collection and other great value books. Colors to be selected by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine floors for suitable conditions where metal storage shelving will be installed.

C. Examine walls to which metal storage shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Vacuum finished floor over which metal storage shelving is to be installed.
3.3 INSTALLATION

A. Install metal storage shelving level, plumb, square, rigid, and true, and within erection tolerances specified.
1. Anchor shelving units to floor with postinstalled expansion anchors or power-actuated fasteners through foot plate. Shim foot plate as required to achieve level and plumb installation.
2. Install seismic supports and bracing as recommended by manufacturer and authorities having jurisdiction, and as required for stability. Extend and fasten members to supporting structure.
3. Connect side-to-side shelving units together at corner posts with support ties.
4. Install shelves in each shelving unit at spacing indicated on Drawings.
5. Post and Beam Metal Storage Shelving: Install beams with rivets fully engaged in post perforations.

B. Erection Tolerances: Erect metal storage shelving with a maximum tolerance from vertical of 1/2-inch from 0 to 10 feet of height and remaining constant at a maximum of 1 inch for all heights taller than 10 feet.

3.4 ADJUSTING AND CLEANING

A. Verify that shelves adjust easily and properly.

B. On completion of installation, clean exposed surfaces as recommended by manufacturer.

C. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.

D. Replace metal storage shelving that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION
SECTION 10 71 13

EXTERIOR SUN CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Solar control fixed shade system.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data: List components and accessories for fixed shade system and show compliance with specified requirements.

B. Shop Drawings: Showing layout, materials, dimensions, tolerances, method of anchorage, and installation details.
   1. Shop drawings and design values of V, M, H, factored reactions imposed on supporting structures shall be provided to the Structural Engineer for review.

C. Samples
   1. Finishes for selection by the Architect.
   2. 6-inch long blade sample with specified finish.

1.3 QUALITY ASSURANCE

A. Sole Source Responsibility: Complete sun control fixed shade system including attachment hardware shall be provided by single firm to ensure compatibility of components and functional operation.

B. Manufacturer: Company specializing in design and fabrication of fixed shade systems with 20 years minimum successful experience.

C. Installer: Experienced in installing fixed shade system of type specified and approved by shade manufacturer for installing system.

D. Design sun control fixed shade system to meet plus 40 and minus 20 pounds per sq. ft. wind load required.

1.4 WARRANTIES

A. Provide 5-year manufacturer's warranty to cover sun control fixed shade system against manufacturing defects.

B. Prove 1-year installer's warranty to cover defects in installation of system.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Sharchs Corporation; DAMS Incorporated, or equal.

2.2 SUN CONTROL FIXED SHADES

A. Construction: Extruded aluminum frame and blades; finish as selected by the Architect from manufacturer’s available range.

B. Configuration and Layout: As indicated on the Drawings.

C. Mounting: Rectangular frame with horizontal blades and end caps shall be mounted to building structure; depth of frame as indicated on the Drawings. Wall brackets supporting frame shall be aluminum; mounting screws shall be stainless steel.

2.3 FABRICATION

A. Preassemble fixed shade system at factory. Minimize requirements for field splicing and assembly. Disassemble units as required for shipping and handling. Label units for reassembly and installation at site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Contractor shall field verify dimensions prior to commencing fabrication.

B. Contractor shall review site conditions and verify that support elements are properly sized, prepared, and ready to receive fixed shade system before ordering the start of installation.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions and approved shop drawings.

B. Accurately space and securely attach brackets to support structure. Connect fixed shade assembly arms to brackets.

END OF SECTION
SECTION 11 40 00
FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Equipment and fittings specified, shown, and described in these Specifications.

B. Utility lines: Wiring and piping required within equipment or component configuration. Terminate lines at designated and accessible points for connection in field. Exposed lines shall be chrome-sleeved or chrome plated.

C. Electrical: Switches, terminal boxes, circuit panels, cords and plugs, controls, solenoid valves and motor starters for equipment provided herein; electrical receptacles mounted in or on Foodservice Equipment, where applicable.

D. Plumbing: Sink faucets, drains, strainers, and tailpieces; vacuum breakers, where attached to equipment; equipment fill faucets.

E. Food Service Equipment Contractor to coordinate and verify all requirements of Owner, Purveyor, Operator, Other, Etc. equipment items that are located within the kitchen & servery areas and indicated on FS series drawings or within specification section 114000.

1.2 RELATED WORK

A. Equipment furnished as part of this section, but installed as part of work within other sections:

B. Fittings: Where applicable, furnish electrical and mechanical fittings, valves, switches, controls, regulators, strainers, and devices required for the proper operation of the equipment except as specified otherwise herein. Where such items are not mounted on the equipment, furnish items to the appropriate contractor the building site for installation in the utility lines.

1.3 ARCHITECTURAL / STRUCTURAL / MECHANICAL / PLUMBING / ELECTRICAL WORK

A. Utility rough in, utility lines and final connections between rough-in and foodservice equipment are part of Plumbing, Mechanical and/or Electrical drawings and specifications.

B. Installation of mechanical and electrical fittings and devices in utility lines, including interconnecting field wiring/piping between foodservice equipment are part of Plumbing, Mechanical and/or Electrical drawings and specifications.

C. Final disconnects electrical receptacles in building structure; contactors; and conduit in structure required for electrical lines are part of Electrical drawings and specifications.
D. Floor drains, floor sinks, P-traps, shut-off valve, grease traps/interceptors, water heaters, pressure reducers and regulators are part of Plumbing drawings and specifications.

E. Backing plates or blocking in wall or ceiling partitions are part of Architectural / Structural drawings and specifications.

F. The forming of architectural enclosures, floor, wall openings or recesses for foodservice equipment are part of Architectural / Structural drawings and specifications.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. At least 5 years’ experience in this type of work. Upon request provide at least three references for jobs of similar size and content.
   2. Commercially manufactured equipment is not acceptable unless evidence furnished that similar equipment has been operating successfully in a minimum of three (3) installations (excluding testing laboratories, field-testing or prototypes) for at least one (1) year.
   3. Commercially manufactured equipment will be reviewed based on submittal data provided on manufacturer’s literature and/or manufacturers shop drawings for prime alternate or substituted items. Failure of the equipment to meet the capacity, operation, size, utility and production as submitted will result in the rejection of the equipment regardless of disclaimers. All equipment items where available to be provided as Energy Star rated and listed.
   4. Custom-fabricated equipment shall be manufactured by a foodservice equipment fabricator with at least five (5) years’ experience in this type of work, who has the plant, personnel, and engineering facilities to properly design, detail and manufacture high quality kitchen equipment.
   5. All millwork and fabrication of wood component products to be performed by a qualified manufacturer that is certified for chain of custody (COC) by an FSC-accredited certification body.

B. References:
   1. ADA - American Disabilities Act.
   2. AGA - American Gas Association
   4. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
   5. ASME - American Society of Mechanical Engineers, Inc.,
   7. BOCA - Building Officials and Code Administrators.
   8. ETL - Electric Testing Laboratory.
   9. FDA - U.S. Food and Drug Administration.
   11. ICBO - International Conference of Building Officials.
   12. NBFU - National Board of Fire Underwriters.
   13. NEMA - National Electrical Manufacturers Assoc.
   14. NSF - National Sanitation Foundation.
   15. PS - U.S. Dept. of Commerce Product Standards.
   16. UL - Underwriters Laboratories, Inc.
17. USDA- United States Department of Agriculture.

C. Requirements of Regulatory Agencies:
   1. NSF Compliance: Equipment subject to NSF approval shall be so labeled, or shall be constructed in accordance with applicable published NSF standards.
   2. Evaporators to be NSF approved; electrical components UL (or ETL) approved.
   3. Electrical Equipment: Equipment shall carry UL (or ETL) approval and comply with applicable standards of the National Electric Code. Where specified, items shall be UL approved as a unit; if not so specified component electrical parts shall be approved separately. Where applicable, equipment shall comply with NEMA and NBFU standards. Where local regulations permit, a certified test report by an approved nationally recognized independent testing organization establishing proof of conformance to the standards, including test methods of UL, will be considered in lieu of UL label. All drop-in equipment to be wired with waterproof conduit.
   4. Civil Authorities: Comply with ordinances, codes and regulations of civil authorities having jurisdiction at Job Site.
   5. Sheet Metal Fabrication: Comply with NFPA standard No. 51: "Welding and Cutting"; and applicable NSF standards.
   6. ADA Compliance: Installation and construction of equipment and furnishings to comply with the American Disabilities Act as described in the Department of Justice Register Volume 56, No. 144. Food service aisles shall be a minimum of 36” wide and tray slides shall be mounted at 34” maximum above the floor. Food service equipment requires to be accessible shall conform to all reach requirements in CBC figures 11B-16 and 11B-17.
   7. Where applicable, installation of equipment to be in accordance with local/state seismic zone requirements.

1.5 DISCREPANCIES

A. In the event of discrepancies within the Contract Documents the Consultant, shall be so notified, within sufficient time, to verify, correct and create addendum.

B. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The drawings govern in matters of quantity, and the specifications govern in matters of quality. In the event of conflict within the drawings involving quantities, or within the specifications involving quality, the greater quantity and higher quality shall apply. No additional allowances will be made because of errors, ambiguities, or omissions, which reasonably should have been discovered during the preparation of the Bid.

1.6 ACCEPTABLE MANUFACTURERS

A. Where such term is followed in the specifications by the names of one or more manufacturer, such manufacturer may be substituted for prime manufacturer named, providing that the alternate item is equal or superior to the brand specified in terms of construction, function, efficiency, and utility. Burden of proof will be on the Contractor. The Contractor shall note such alternates in his Bid. Acceptance of Contractor's Bid does not imply acceptance of alternate items. The Contractor is responsible for any additional costs associated with changes required to building construction and utility due to alternate equipment items (i.e.: larger/smaller electrical breakers/wiring; increase in propane.
gas/water piping size and/or consumption).

B. All alternates of Energy Star rated / listed equipment to also be Energy Star rated or listed to be considered as equivalent.

1.7 SUBSTITUTIONS

A. Requests for substitution of equipment manufactured by other than the Prime or Alternate Manufacturers named in the specification shall be submitted prior to bid opening. Such items will be reviewed and accepted or denied during the bidding period only and accepted or rejected on the basis of equality to the prime equipment specified.

B. Contractor Must: Submit full descriptive and technical data, test results in detail, and samples, if requested, to be received by the Architect in accordance with Division 1 Specifications.

1.8 SUBMITTALS

A. All submittals to be provided in electronic PDF format. Minimum sheet size for all shop drawings to be 24”x36”.

B. Submittals to be provided in the following sequence. 1-Underground utility penetration MEP plan; 2-Itemized equipment cutsheets; 3-Manufacturers shop drawings (hoods, walk-ins, refrigeration systems or other); 4-MEP Rough-in Shop drawings and 5-Custom fabricated equipment (counters/tables etc.) shop drawings. NOTE: MILLWORK STAINLESS AND SNEEZE GUARDS TO BE DRAWN AND (1) CONSOLIDATED SET SHOWING ALL DETGAILS OF MILLWORK, STAINLESS, EQUIPMENT AND SNEEZE GUARDS.

C. Product Data:
   1. Equipment Brochure:
      a. Provide list of equipment items with item number, manufacturer, and Model No. and quantity in front of product data books.
      b. Form: Print item number clearly in upper right-hand corner of each sheet; show manufacturer's name; model number; options, alternates, or attachments, electrical and mechanical data, and valves, regulators, controls, and devices provided. If no printed data exists, submit required information on manufacturer's drawing(s) in form described below for Shop Drawings; insert reference sheet in brochure in number sequence referring to item number, manufacturer, and drawing number. Include Company's name and address, project name, and submittal date on brochure cover.

D. Shop Drawings: Submit the following along with equipment brochures:
   1. Floor Plans: No less than 1/4” to 1’-0” scale. Include itemized equipment layout(s), equipment schedules, and rough-in plans. Reproductions of Contract Documents for purposes of shop drawing preparation are not acceptable.
   2. Rough-In Plans: Include mechanical and electrical equipment requirements, including Owner, By Other, By Vendor, etc. furnished equipment. Identify connection points, and identify and dimension rough-in points (including those presently sleeved, if) with both vertical (above finished floor), and horizontal dimensions from column.
centerlines or exterior walls. Detail and dimension structural recesses and depressions required for equipment provided.

3. Shop Details: Food Service Equipment Contractor/Fabricator is required to provide shop drawings for approval by consultant, prior to fabrication. Scale: not less than 3/4” to 1’-0”, larger where required for clarity. Show plans, elevations, sections and details of equipment as required to indicate arrangements, construction, and connection with other Work; Kinds, types, grades, thickness and finishes of materials; reinforcements, joints, bracing, supports, and anchorage; and method of installation. Food Service Equipment Contractor/Fabricator to coordinate fabrication/installation of counter with equipment items that are to be dropped into top, roll under and be attached to/through counter (sneeze guards, cooking equipment, etc.). Note: All fabrication drawings that are a combination of multiple fabricated or custom manufactured components/items are to be provided as one shop drawing, no exceptions. All fabrication shop drawings are to indicate equipment cut-out requirements/dimensions. Shop drawings to include multiple sections through counter/equipment/sneeze guards (provide minimum (3) three sections serving counter). All drawings to show, at a minimum in plan view, the equipment items (below) (counters, etc.) that are covered by the sneeze guard. Side views to indicate compliance with NSF codes for sneeze protection.

4. Backing Drawings: Submit separate drawings locating architectural backing required to support equipment. Dimension in plan, elevation, and (where required) in section. Show maximum load factors for each item requiring wall, ceiling, or special floor support.

E. Certificates: Provide certifications of compliance with requirements of governing regulatory agencies.

F. Operating and Maintenance Data:
   1. Refer to the following and Division 1 specification requirements.
      a. Inventory List: Before final payment, submit an "as-built" list of equipment provided indicating item number and name; manufacturer and model, where applicable; and item price. Include extra equipment, if, ordered during the progress of the Work.
      b. Mechanical Refrigeration: After installation, submit an “as-built” diagram of refrigeration piping system including location, manufacturer and model, number of gauges, valves, shock absorbers and devices.
   2. Service Agencies: After award of a contract, submit a list of names and addresses of service agencies to be used on the project. Agencies shall be approved by the Owner Representative and shall be from the jobsite area or within a 150 miles radius from the project.
   3. Nameplates: Provide permanently affixed, corrosion resistant nameplate, proportionate to size of fixture, bearing manufacturer's name, model and serial numbers, and ratings and characteristics for servicing and maintenance, where applicable, on each item of equipment.
   4. Operating and Maintenance Manuals: Upon substantial completion of project, provide completed, bound manuals for each applicable item of equipment provided. Include operating and maintenance instructions/diagrams, wiring diagrams and replacement parts lists/diagrams. Provide list of serial numbers corresponding to each Item Number in the front of each manual.
G. As-Built Shop Drawings: Submit the following at project completion.
   1. As-Built/Constructed equipment Floor Plans: No less than 1/4” to 1’-0” scale. Include itemized equipment layout(s), equipment schedules, and rough-in plans.
   2. Rough-In Plans: Include mechanical and electrical equipment requirements, including Owner, By Other, By Vender, etc. furnished equipment.
   3. Drawings to include incorporation of all provided responses to RFI’s, change requests or/and any other changes incorporated in the field documented or un-documented.

H. LEED Submittals: Complete Material Buyout Form (MBoF) with all materials provided to Project. Complete submittal includes providing all material costs in MBoF and all supporting documentation for the following credits:
   1. MRc3 - Sourcing of Raw Materials –
      a. Recycled Content: Cutsheet, product literature or letter from manufacturer that clearly indicates the percentage by weight of post-consumer and pre-consumer (post-industrial) recycled content.
      b. FSC Certified Wood: For all wood products designated in this specification as "FSC certified," provide vendor invoices with the vendor's chain-of-custody (COC) number and identify each FSC certified product on a line-item basis. If FSC wood products are modified off-site by an architectural woodworker or millworker, the woodworker must have an FSC COC number which must appear on the project invoice.
      c. Extended Producer Responsibility: Provide cutsheet, product literature, or letter from manufacturer that clearly indicates that the manufacturer participates in an extended producer responsibility program.
      d. Local/ Regional Material: For any materials contributing to MRc3 that are manufactured and extracted within 100 miles of the project Site, provide cutsheet, product literature, or letter from manufacturer indicating the location of harvest, processing, and manufacturer, and proximity from the project site.
   2. IEQc2 - Low-Emitting Materials –
      a. Composite Woods & Laminate Adhesives: For composite woods, agrifiber products & laminate adhesives permanently installed on site Include product data indicating the product is CARB Phase II compliant or with Ultra-low emitting Formaldehyde (ULEF) or No Added Formaldehyde (NAF).

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Equipment:
   1. Coordinate delivery with proper schedule and jobsite conditions.
   2. Deliver equipment in manufacturer's original packaging, clearly identified as to product, manufacturer, and Item Number corresponding to numbers in the itemized specification.
   3. Where possible, deliver each item of equipment in one (1) piece. If not possible, assemble equipment in the building in accordance with workmanship standards specified herein.

B. Storage of Equipment:
   1. Store equipment in protected areas, in manufacturer's original packaging where possible, in such a way as to prevent damage to equipment and finishes, and to the structure. Damaged or defective materials and equipment shall be replaced at no cost.
1.10 SITE CONDITIONS

A. Examine appropriate existing job site areas and notify Owners Representative if conditions exist which will impede, inhibit, or prevent the contractor from completing the Work. In the absence of such notification it will be assumed that no such conditions exist.

B. Verify site conditions and dimensions prior to production of all equipment items, notify GC of any conditions that affect ability to complete scope of work. Any fabricated/buy-out equipment items that are to abut and be sealed to walls must not have any gaps greater than 1/8” – if gaps exceed dimension the GC and Design team can reject and or accept on a condition by condition bases. All costs associated with replacing improperly provided equipment items is the responsibility of the food service equipment contractor.

1.11 COORDINATION

A. Coordinate work as part of this phase, including but not limited to Mechanical, Electrical and Foodservice Equipment Installation. Do cutting, drilling, and fitting in equipment necessary to accommodate work of mechanical and electrical connections.

1.12 WARRANTIES

A. Work shall be guaranteed against defects for one (1) year from the date of operation of the equipment. Guarantee shall cover replacement of every particular piece of defective material, including transportation, installation and labor, but shall exclude replacement cost of damaged parts or work caused by carelessness or misuse of the equipment. If the contractor fails to respond to written notification of warranty item within 10 days, the Owner may then have the defects and/or problem corrected at the contractor’s expense.

B. In addition to the standard warranties, for equipment, guarantees or warranties offered by manufacturers or contractors in excess of the standard warranties (for example, 5-year warranties on motor-compressors) shall be consigned to and deemed to run to the benefit of the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURED EQUIPMENT

A. General: Equipment so identified refers to Item bearing a manufacturer's name and/or model number. Such standard materials, components, and features normally furnished for that model, whether noted or not, are inherent in the specification.

B. Utility Requirements: major deviation from the utility requirements shown or specified, resulting either from change of model or manufacturer, or from submitted alternates, shall be clearly indicated on the submittals. Additional costs incurred as a result of a failure to do so shall be borne by the general contractor.

C. Sanitation: manufactured equipment shall be either sealed to walls, with no openings or crevices between wall and equipment, or shall be installed the proper distance from wall, as
required by NSF. Wall shelving shall be 1” minimum from wall or sealed thereto.

2.2 MATERIALS

A. General: new and first grade. See also various types of equipment, e.g., Sheet Metal Work.

B. Metal:
   1. General: Metal gauges specified are minimum and refer to U.S. Standard Gauge for sheets and plates and to Stub Gauge for tubular material. Gauges established after polishing in accordance with ANSI standards.
   2. Stainless Steel: ASTM A167, type 304, 18-8, No. 2D finish on totally concealed surfaces, No.4 finish elsewhere.
   5. Metal Tubing and piping: Seamless or welded, of true roundness or square. Seamless tubing: annealed, pickled, and ground smooth. Welded tubing: heat-treated and quenched to eliminate carbide precipitation, drawn true to size and shape, ground smooth.

C. Galvanizing Repair Compound: USDA approved and UL listed (components), "Z.R.C. Cold Galvanizing Compound", or General Electric "Silastic".

D. Sound Deadening: Under sheet metal tops apply sprayable, non-combustible cellulose fiber material "Catalog number K-13", type "A", National Cellulose Corporation, or equal.

2.3 LEED COMPLIANCE REQUIREMENTS (applicable to both custom fabricated and manufactured equipment items)

A. All materials used in the manufacturing or assembly of food service equipment items to utilize and/or contain the maximum amount of recycled content allowed to retain the materials integrity.

B. Preference shall be given to manufacturers whose facilities are within a 100 mile radius to the project site. Manufacturers and custom fabricators to give preference to raw material providers that are within a 100 mile radius to their manufacturing and/or assembly facility.

C. Composite Wood shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" (CARB Phase II) or shall be made with no added formaldehyde (NAF).

D. Certified Wood: 100% of wood products must be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
2.4 **FABRICATION, STAINLESS COUNTERS, STAINLESS TABLES**

A. **General:** The following standards apply to new construction and to modification of existing equipment:

1. **Welding:** Heliarc or electric arc method, welding rod of same composition as parts welded. Joints finished smooth, polished, and re-grained. No weld visible on exposed surface. Welding shall be non-toxic on surfaces exposed to unpackaged food. Provide continuously welded joints for fixture tops, shelves, face joints in base cabinets, field joints and others where required.

2. **Finishing:** No depressions, warpage, burns, brake bend marks, burrs, fins, or irregular projections. Welds on galvanized steel: grind smooth, clean, and coat with acceptable galvanizing repair compound. No tinning. Painted galvanized surfaces: remove film with phosphoric acid or similar solution: apply wash primer surface preparation coat; color as selected. Brass surfaces: Apply clear lacquer finish to brass fixtures after fabrication.

3. **Sanitation:** Close hollow sections in fixtures by continuous welding. Cove horizontal and vertical intersections of sheet metal 5/8” radius, minimum, unless otherwise specified. Install fabricated equipment, with relation to the wall, as described above for manufactured equipment, including wall shelves.

4. **Fastenings:** Where possible, no exposed bolt, screw or rivet heads. Bolts and screws: Acceptable concealed type, corrosion-resisting steel same composition as metal surface. Where concealed fastenings not possible: stainless steel countersunk, of flat or oval head design. All-American Standard Unified thread design. Threads visible or accessible capped with lock-washers and chrome plated brass or bronze acorn nuts. Others capped with standard lock-washer and steel nut.

5. **Catalog Items:** Construction standards herein apply to custom-fabricated equipment. Where similar items are referred to by manufacturer and model number, the manufacturer's standard construction as published in the literature (unless modified within the specification) shall be considered the construction standards for that item.

B. **Construction Standards:**

1. **Work tops:** 14-gauge stainless steel. Lower edges of tops 3/4” minimum from table framing. Tops at 34” from finished floor unless otherwise specified. Backsplashes: At walls or higher fixtures, formed of same piece as top with 1” return standard, 2-1/2” minimum where piping or conduit required. Form as detailed. Seal top to wall with clear silicone sealant. Close ends with continuously welded fillers of same material. See "Materials" for sound deadening.

2. **Three compartment utensil sinks:** 12 gauge stainless steel tops.

3. **Reinforcing:** Weld to underside of tops, 14-gauge steel hat sections or channels, full perimeter with cross members at 36” O.C. maximum. Concealed framing (in enclosed cabinets or behind turned down edges): galvanized steel. Exposed framing: stainless steel.

4. **Aprons:** Material specified. Weld to underside of fixture top framing. Bottom edges turned back 1/2” on obtuse angle. Form corners on radius around legs.

5. **Open bases:** Provide 1-5/8” inch O.D. x 16 gauge stainless steel tubular legs fitted at top to tubular, fully enclosed, slip-fit, reinforced leg sockets welded to table framing and at bottom to stainless steel adjustable "bullet" type feet. Pins and floor flanges, where specified: stainless steel, welded to feet. Legs connected by cross rails, same material and finish, except where shelves are located, or where front access is required.
for bins. Rails at 10” O.C. above floor, unless otherwise shown. Provide four (4) legs for tops up to 84” long, six (6) legs for larger tops.

6. Rolled Edges: Rolled edges shall be as detailed, with corners bullnose, ground and polished.

7. Coved Corners: stainless steel Foodservice equipment shall have 3/8” or larger radius coves in horizontal and vertical corners and intersections per N.S.F. standards.

8. Closures: Where ends of fixtures, splashback, shelves, are open, fill by forming the metal, or weld sections, if necessary, to close entire opening flush to walls or adjoining fixtures.

9. Undershelves, Open: 16-gauge stainless steel. Square down free edges, notch around legs, continuously weld. Turn up edges abutting walls or fixture 2” minimum and hem back. Reinforce underside as for tops.

10. Draintables:
   a. General: 14-gauge stainless steel. Pitch to drainage point 1/4” per lineal foot with 1” maximum pitch. Low point of top: 34” from floor. Secure and make watertight connections to warewashing machines. Free edges standing rolled type unless otherwise specified, other edges formed into backsplashes as specified for worktops. Continuously weld disposer cones to table. Reinforce top as above for worktops, with additional lateral members on each side of cone. Mount on open bases unless otherwise specified. Drainboards more than 24” long shall be leg supported.
   b. Standing rolled edges: Turn up at 90 degrees, roll outward and downward 180 degrees on 1-1/2” inch minimum outside diameter. Outside corners rounded on 2” radius. Top of roll; 37” from floor, 3” maximum from drain table top.

11. Sinks:
   a. General: 14-gauge stainless steel, fully coved, continuously welded. Pitch sink bottom to die formed drain opening, depressed below sink bottom. Continuously weld sink bowls to fixture tops. Specified sink depth measured from adjoining surface or, if freestanding, from 34” from floor. Provide faucets and drain fittings as specified.
   b. Multiple-compartment sinks: Space bowls a minimum of 2” apart. Top closure 14-gauge stainless steel continuously welded to sink bowls, rounded on 5/8” radius minimum. Weld two (2) 1/2” diameter stainless steel rod spacers between each bowl 2” from bottom, one (1) each at front and rear. Scullery and vegetable washing bowls shall be leg-supported. Weld 16-gauge stainless steel, full height closure panel across front and ends of sink bowls, construction vermin-proof, NSF approved. Scullery and vegetable washing sinks are to be integral with the body. Welded in sinks not acceptable.

12. Counter-Mounted Equipment (Electrical/Mechanical):
   a. General: Install built-in equipment neatly and tightly in accordance with manufacturer's instructions; no crevices or gaps acceptable. Install wiring and piping for all elements, controls, and fittings within counter to accessible junction point. Conceal lines and fittings in base cabinets, tubular uprights, raceways. Where required, cut holes in counter tops for wiring and piping, and install rubber grommets for cords. All foodservice equipment with remote controls or exterior wiring to be installed with liquid-tite.

13. Elevated Shelves:
   a. General: 16-gauge stainless steel, free edges squared-down as for undershelves, unless otherwise shown. Turn up edges abutting walls or other fixtures 1” minimum and crimp back for tight fit. Close free ends. Mount at 18” above
work surface unless otherwise shown. Reinforce underside of shelves 14” deep or greater.

b. Wall Shelves: Stud or tack-weld to 12-gauge stainless steel cantilever brackets. Secure brackets to wall rigidly on 36” 0-inches centers, maximum.

C. Manufactured Components (Unless specified otherwise):
   1. General: Provide the following items, or approved equivalents, for installation in custom-fabricated equipment where applicable at all sinks etc.
   2. Faucets:
      a. General: Removable-cartridge type, with polished chrome finish, and fitted with aerators, as manufactured by Chicago, Inc., or equivalent models by Fisher Faucet.
      b. Swing Spout, Standard: Deck-or-splash-mounted, as shown. For sinks 30 Gal. or larger: Chicago #540-LD-L9 with 3/4” NPT inlets: for smaller sinks: Series B-230 with 1/2” NPT inlets. Nozzle lengths equal to one-half width of sink or as specified and shown.
      c. Provide deck or splash mounted pre-rinse at pre-rinse sink, Chicago #919 or 510GC with wall bracket. 1.3 GPM or less.
   3. Drain Fittings:
      a. Twist-handle type: Box pattern drains with heavy duty, stainless steel removable basket assembly, twist-handle waste outlet, and one-piece connected overflow assembly, by Component Hardware Group, Inc., or equivalent model by Klein Hardware. For sinks between 20 Gal. & 30 Gal., provide Model No. D63-4591; less than 20 Gal., provide Model No. D53-7215. Centerline of overflow connection 2” below sink top. Weld 12-gauge stainless steel strap lever support to underside of sink at front, if required. Lever handle to be installed aligned with front edge of sink bottom.

2.5 FABRICATION – MILLWORK

A. General: The following standards apply to new construction. LEED compliance products and construction required.

B. Counter Bodies: Furniture grade 3/4” plywood with blocking. Exposed surfaces shall be plastic laminated, (color/pattern as selected by Architect). Construction shall be suitable for a Foodservice environment.

C. Finishes: As specified by Architect.

D. Fastening: No exposed bolts, nails or screws will be acceptable in counter or cabinet construction.

E. Laminated Plastic:
   1. Shall be LaminArt, unless otherwise specified by Architectural Drawings or Specifications.
   2. Shall be veneered with approved waterproof and heat proof cement. Rubber base adhesives are not acceptable.
   3. Exposed faces and edges shall be faced with 1/16” thick material. Corresponding backs shall be covered with approved backing and balancing sheet material.
F. Components:
1. Legs: Tubular stainless steel with adjustable feet or as specified/detailed.
2. Hardware: Cabinet door hardware as specified by Architect.
3. Locks: All cabinet doors to be provided with locking mechanisms as required – Cylinder locks as manufactured by CHG.

2.6 COLD STORAGE ROOMS

A. Not applicable to this project.

2.7 MECHANICAL REFRIGERATION SYSTEM

A. Not applicable to this project.

2.8 EXHAUST HOODS

A. Stainless steel construction. See shop drawings for size and location of ducts.

B. Provide stainless steel closure panels above hood to finished ceiling, or stainless steel angle trim at hood if directly below ceiling, verify height.

C. Lights per shop drawings.

D. Supply wall flashing; unless specified otherwise.

E. Provide fuse-linked fire dampers in exhaust and make-up air duct collars, if required. Verify with Fire Marshal.

F. Hoods to utilize a wet chemical Fire Suppression System.

G. Bottom of hood to be mounted as delineated in itemized specification.

2.9 FIRE PROTECTION SYSTEM

A. The fire protection system shall conform to applicable code requirements including but not limited to NFPA and UL 300.

B. Provide surface appliance, hood and duct protection nozzles per equipment shown.

C. Exposed piping to be chrome plated or sleeved. Run unexposed wherever possible.

D. Provide manual pull station as located on drawings with two (2) sets of normally open/close contact points.

E. Coordinate shunt-trip circuit breaker coil voltage and interface requirements.

F. Coordinate solenoid operated gas valve coil voltage and interface requirements.

G. Upon completion the system must be tested in the presence of the City Fire Marshal.
H. Permit and testing to be included in scope of work provided as part of section 11400.

I. Provide Automan for use with single ducts on multiple hoods.

J. Provide durable plastic maps/legends/signs at each manual pull station and for each system to show the effected hoods. Provide training for the cooks and maintenance staff as to how the system works.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field Measurements: Prior to fabricating, ordering, or delivering equipment verify essential measurements at the Work Site. Verify mechanical and electrical conditions having bearing on the work, as well as pertinent existing equipment and architectural conditions. Make every effort necessary to clarify conditions not accessible to visual examination. Any fabricated/buy-out equipment items that are to abut and be sealed to walls must not have any gaps greater than 1/8” – if gaps exceed dimension the GC and Design team can reject and or accept on a condition by condition bases. All costs associated with replacing improperly provided equipment items is the responsibility of the food service equipment contractor.

B. The food service equipment contractor is responsible to locate all equipment in the field for installation by themselves or any of their subcontractors – this includes both buy-out and custom fabricated equipment items. Contractor to coordinate installation with installed rough-ins and make any adjustments required to equipment to accommodate.

3.2 INSTALLATION

A. Cutting and Welding Operations: gas operated cutting and welding equipment and operations shall be in strict accordance with the National Fire Protection Association Standard No. 51.

B. Standards: Comply with NSF standards in methods of installing, mounting, and securing equipment.

C. Trim: Where separate fixtures abut each other as in a battery of cooking equipment, join, seal, and fit with matching trim strips to eliminate crevices. Where fixtures penetrate or abut walls, fit wall edges with trim molding, of matching material, to close spaces between fixture and building structure. At wall penetrations mount fixture on enclosed channel base of similar material to close spaces, where specified.

D. Irregular Surfaces: Where fixture abuts curved or irregular surfaces or angles, or projecting wall corners, fixture shall conform to such surfaces.

E. Metal Bases: Set bases in solid, full-perimeter bed of sealant. If space exceeds 1/4” at point, provide a continuous, full-height scribe strip of matching material to conceal gap.
3.3   FIELD QUALITY CONTROL

A. After installation, test mechanical and electrical equipment including, but not limited to refrigeration systems, and in general valves, regulators, tubing, wiring, piping, connections, gauges, safety devices, sensors, and other devices required for the proper operation of the equipment, for operating efficiency and conformance to requirements specified. Test and re-test until equipment is properly operating.

B. Manufacturer's representative Field Service: Representatives of the Food Service Equipment and Accessory manufacturers shall make inspections prior to start of installation, during installation and upon completion of installation to ascertain that the entire system(s) has been installed according to manufacturer's specifications and approved details.

3.4   ADJUSTMENT AND CLEANING

A. Perform fitting, joining, leveling, fastening, scribing, sealing, and adjusting of fixed equipment; depot mobile and portable equipment as shown. Do cutting, drilling, and fitting in equipment necessary to accommodate work of mechanical and electrical trades.

B. Cleaning: Remove from equipment stains, paint spots, protective wrappings, coatings, tapes, grease, oil, plaster, dust, polishing compounds, rust, and other foreign substances.

C. Touch-up: After installation, damaged, stained, or otherwise disfigured portions of the work shall be touched up, refinished, or replaced to the satisfaction of the Owners representative.

3.5   DEMONSTRATION/COMMISSIONING

A. Prior to final acceptance, Food Service Equipment Contractor is to schedule and provide for factory authorized representative or service agent to demonstrate and instruct operating personnel in the uses and maintenance of all equipment provided – No exceptions. In the case of complex equipment, demonstrations shall utilize videotapes as provided by the manufacturers. Such equipment shall include but not be limited to major cooking equipment; exhaust ventilation systems, food processing equipment (such as cutters, mixers, slicers); warewashing equipment; and complex control, monitoring, and alarm systems. Provide RAS with schedule of start-up and demonstrations.

B. Process of commissioning of equipment to include the following:
   1. Factory authorized representative or service agent to verify that all utility connections are complete and proper per manufacturer’s requirements and specifications.
   2. All equipment to be started up and tested for proper operation by the factory authorized service agent or representative. Start-up and testing done by the G.C. does not constitute acceptance by Owner, owner’s representative and/or design team.
   3. At time of start-up a commissioning form is to be completed and signed by the factory representative or authorized service agent that has performed the work, Form to indicate date, time, name and company name of representative, equipment item # and description, duration of visit, and names of staff equipment demonstrated to.
3.6 ITEMIZED EQUIPMENT DESCRIPTION

C. Refer to all FS Drawings as they are inclusive as the construction documents and therefore pertinent with this specification to the details of this contract. In the event of a conflict, the greater quality of the two in conflict shall apply.

D. Refer to contract document drawings for quantities required, general notes, utility load requirements etc.

E. Contractor is required to list name of intended custom fabrication company at time of bid.

Item 1: Dry Storage High Density Shelving
Manufacturer: Metro
Model: BR Series - Top Track
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Sizes, quantities and configurations per plan (1) one set/assembly required. Assembly to consist of 18” deep units.
2. Furnish Metro Model Top Track rolling shelving system, complete per manufacturer’s standard specifications.
3. Provide end units each (5) five BR series shelves, and four (4) BR series 86” posts, on four (4) each foot plate/leveling foot assemblies.
4. Provide mobile units consisting of five (5) BR series shelves, and four (4) BR series 86” posts (vfy.), on four (4) each 5” locking casters for mobile units.
5. Provide overhead Top-Track rolling rack assembly sets, securely fastened between end units and to cabinet above and sides.
6. Overall assembly length to be as indicated on plan and field verified.
7. Provide all necessary options and accessories for assembling and connecting components to complete installation and provide a functional storage system.
8. Each unit to contain 5-Five BR series shelves equally spaced with first shelf mounted min 6” above finished floor.
9. Wall brackets to be installed for stability.

Item 2: Freezer, Reach-In
Manufacturer: True
Model: STA1F-1S-HC
Acceptable Alt: Victory, Traulsen or Delfield
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2 Products, Part 3 - Execution and the following:
1. SPEC SERIES® Freezer, Reach-in, -10°F, one-section, stainless steel front & sides, (1) stainless steel door with lock, cam-lift hinges, digital temperature control, aluminum interior, (3) chrome shelves, LED interior lights, R290 Hydrocarbon refrigerant, cULus, UL EPH Classified, MADE IN USA.
2. Door hinged right standard
3. Stainless steel back
4. Provide with optional accessories:
   a. (3) chrome shelves and shelf supports standard per section
   b. Spec Kit #1 - (9) sets of #1 type tray slides (specify for left, center or right section)
c. Spec Kit #2 - (1) set of #2 type tray slides (equips 1/2 section only) (specify for left, center, or right section AND top 1/2 or bottom 1/2)
d. Spec Kit #3 - (6) sets of universal type tray slides (specify for left, center or right section)
e. Spec Kit #4 - (3) chrome shelves & shelf supports (specify for left, center or right section)
f. #1 type tray slide for (1) 18"x26" or (2) 14"x18" pans, set of 2
g. #2 type tray slide for (1) 18"x26" pan (equips 1/2 section), set of 2
h. #3 universal type tray slide for (1) 18"x26" or (2) 12"x20" or (2) 14"x18" pans, set of 2
i. Vinyl coated shelf (includes shelf clip supports) (specify for left, center or right section, if applicable), each
j. Chrome plated shelf (includes shelf clip supports) (specify for left, center or right section, if applicable), each
k. Stainless steel shelf (includes shelf clip supports) (specify for left, center or right section, if applicable), each
l. 5" castors, set of 4, standard
m. Security Package #1, for one-section reach-in refrigerators & freezers, includes stainless breaker covers, light cover, locking hasp(s), non-removable doors, control cover, top screen/guards, security screws (includes required top screen), welded tray slides, seismic/flanged legs

Item 3: Refrigerator, Reach-In
Manufacturer: True
Model: STA1R-1S-HC
Acceptable Alt: Victory, Traulsen or Delfied

Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2 Products, Part 3 – Execution and the following:

1. SPEC SERIES® Refrigerator, Reach-in, one-section, stainless steel front & sides, (1) stainless steel door with lock, cam-lift hinges, digital temperature control, aluminum interior sides & walls, stainless floor & ceiling, (3) chrome shelves, LED interior lights, R290 Hydrocarbon refrigerant, cULus, UL EPH Classified, MADE IN USA, ENERGY STAR®.

2. Door hinged right standard

3. Stainless steel back

4. Provide with optional accessories:
   a. (3) chrome shelves and shelf supports standard per section
   b. Spec Kit #1 - (9) sets of #1 type tray slides (specify for left, center or right section)
   c. Spec Kit #2 - (1) set of #2 type tray slides (equips 1/2 section only) (specify for left, center, or right section AND top 1/2 or bottom 1/2)
   d. Spec Kit #3 - (6) sets of universal type tray slides (specify for left, center or right section)
   e. Spec Kit #4 - (3) chrome shelves & shelf supports (specify for left, center or right section)
   f. #1 type tray slide for (1) 18"x26" or (2) 14"x18" pans, set of 2
   g. #2 type tray slide for (1) 18"x26" pan (equips 1/2 section), set of 2
   h. #3 universal type tray slide for (1) 18"x26" or (2) 12"x20" or (2) 14"x18" pans, set of 2
   i. Vinyl coated shelf (includes shelf clip supports) (specify for left, center or right section, if applicable), each
   j. Chrome plated shelf (includes shelf clip supports) (specify for left, center or right section, if applicable), each
   k. Stainless steel shelf (includes shelf clip supports) (specify for left, center or right section, if applicable), each
   l. 5" castors, set of 4, standard
   m. Security Package #1, for one-section reach-in refrigerators & freezers, includes stainless breaker covers, light cover, locking hasp(s), non-removable doors, control cover, top screen/guards, security screws (includes required top screen), welded tray slides, seismic/flanged legs
screen/guards, security screws (includes required top screen), welded tray slides, seismic/flanged legs

Item 4: Refrigerator, Reach-In
Manufacturer: True
Model: STA2R-2S-HC
Acceptable Alt: Victory, Traulsen or Delfield
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2 Products, Part 3 - Execution and the following:

1. SPEC SERIES® Refrigerator, Reach-in, two-section, stainless steel front & sides, (2) stainless steel doors with locks, cam-lift hinges, digital temperature control, aluminum interior sides & walls, stainless floor & ceiling, (6) chrome shelves, LED interior lights, R290 Hydrocarbon refrigerant, cULus, UL EPH Classified, MADE IN USA, ENERGY STAR®
2. Door hinged right standard.
3. Stainless steel back
4. Provide with optional accessories:

   n. (3) chrome shelves and shelf supports standard per section
   o. Spec Kit #1 - (9) sets of #1 type tray slides (specify for left, center or right section)
   p. Spec Kit #2 - (1) set of #2 type tray slides (equips 1/2 section only) (specify for left, center, or right section AND top 1/2 or bottom 1/2)
   q. Spec Kit #3 - (6) sets of universal type tray slides (specify for left, center or right section)
   r. Spec Kit #4 - (3) chrome shelves & shelf supports (specify for left, center or right section)
   s. #1 type tray slide for (1) 18"x26" or (2) 14"x18" pans, set of 2
   t. #2 type tray slide for (1) 18"x26" pan (equips 1/2 section), set of 2
   u. #3 universal type tray slide for (1) 18"x26" or (2) 12"x20" or (2) 14"x18" pans, set of 2
   v. Vinyl coated shelf (includes shelf clip supports) (specify for left, center or right section, if applicable), each
   w. Chrome plated shelf (includes shelf clip supports) (specify for left, center or right section, if applicable), each
   x. Stainless steel shelf (includes shelf clip supports) (specify for left, center or right section, if applicable), each
   y. 5" castors, set of 4, standard
   z. Security Package #1, for two-section reach-in refrigerators & freezers, includes stainless breaker covers, light cover, locking hasp(s), non-removable doors, control cover, top screen/guards, security screws (includes required top screen), welded tray slides, seismic/flanged legs

Item 5: Clean Dish Table
Manufacturer: Stainless Steel Fabricator
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:

1. Custom configuration per plans. Depth x length per plans and field conditions. Coordinate fit and interface with dishwasher.
2. See elevation for details.
3. 14 gauge stainless steel top with integral rear and side backsplash. Open storage and areas below per details. Top to have standard raised rolled edge.
4. Legs to be 1 5/8" 16 gauge stainless steel tubular type with CHG Model AYE type or better heavy-duty feet with 3" adjustment. Stainless steel crossrails between all legs.
5. Provide splash to 9" at wall with 45º top angled back to wall and 1" turn down to wall.
6. Field verify all dimensions prior to fabrication.
7. 16 gauge stainless steel under shelves per plans.
8. Provide shop drawing for review and approval prior to fabrication and installation.
9. Support channels below top and under shelf.

Item 6: Wall Shelving
Manufacturer: Stainless Steel Fabricator
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. 16 gauge stainless steel top and splash, 300 Series with No. 4 finish, 14 gauge stainless steel “L” wall brackets.
2. Field verify all dimensions prior to fabrication.
3. Provide shop drawing for review and approval prior to fabrication and installation.

Item 7: Warewasher, Door Type, High Temp
Manufacturer: Jackson WWS
Model: Tempstar W/ Booster
Acceptable Alt: Champion Industries or Hobart
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2 Products, Part 3 - Execution and the following:
1. TempStar® Dishwasher, door type, high temperature electric tank heat with built-in booster, universal (straight-thru/ corner) type, approximately (58) racks/hour capacity (0.89 gallons per rack), stainless steel exterior, universal timer, Sani-Sure, dishtable not included, cETLus, ETL-Sanitation, ENERGY STAR®
2. Provide two (2) each Peg Rack and Combination Rack.
5. Flanged feet (TempStar®, TempStar® GPX, Conserver® XL & Conserver® XL2) (set of 4).

Item 8: Soiled Dish Table With Sink
Manufacturer: Stainless Steel Fabricator
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. Custom configuration per plans. Depth x length per plans and field conditions.
2. 14 gauge S/S top with integral rear backsplash, standard 3” rolled edge.
3. One 22” x 22” x 15” deep sink compartment. Provide with removable S/S rack glides.
4. Provide splash to 9” at wall with 45º top angled back to wall and 1” turn down to wall. Pre-drill for pre-rinse faucet.
5. Legs to be 1 5/8" 16 Ga. s/s tubular type with CHG Model AYE type or better heavy-duty feet with 3” adjustment. S/S crossrails between all legs.
6. FSEC to provide fabrication shop drawings for review and approval.

Item 9: Pre-Rinse Faucet, Backsplash Mount
Manufacturer: Fisher
Model: 34436
Acceptable Alt: T&S Brass and Bronze Works or Chicago Faucets
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Pre-Rinse Unit, 8in. adjustable wall mount, with spring action flexible gooseneck, wall bracket, Add On-Faucet with 6in. spout.
2. Wall bracket.
3. Ultra-Spray™ PLUS Valve, with 1.15 GPM nozzle, interchangeable, brass.
4. Provide with low flow nozzle.

Item 10: Drain, Lever Handle
Manufacturer: Fisher
Model: 22209
Acceptable Alt: T&S Brass & Bronze Works or Component Hardware
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Units to be installed within and as part of item #8.
2. DrainKing Waste Valve, with flat strainer, 12 GM drain rate, cast red brass body.

Item 11: Drop-In Strainer/Scrap Basket
Manufacturer: Stainless Steel Fabricator
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. Provide with removable stainless-steel rack glides and one (1) removable perforated scrap basket.
2. Provide with drop-in strainer.
3. Custom configuration per plans and item #8 sink. Depth x length per plans and elevations.
4. FSEC to provide fabrication shop drawings for review and approval.

Item 12: Wall Shelves/Pot Rack
Manufacturer: Stainless Steel Fabricator
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. 16 ga stainless steel top and back/side splash, 14 ga stainless steel wall brackets.
2. See FS elevations series for details.
3. Field verify all dimensions prior to fabrication.
4. Standard turn-down edge all around.
5. Provide with double sided sliding hooks (1) one every 6” on center.
6. Flat stainless steel bar is 2”x1/4”, either Pot hooks all welded stainless.
7. Provide shop drawing for review and approval prior to fabrication and installation.

Item 13: Condensate Hood - Type 2
Manufacturer: Streivor
Model: Refer To Shop Drawing
Acceptable Alt: Gaylord or Accurex
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Air volumes and overall dimensions per manufacturer’s shop drawings provided on shop drawings.
2. Verify and coordinate access into building.
3. Provide trim and closure panels to ceiling and closures between and under hood; 18-gauge type 304 Stainless Steel construction; no exposed fasteners.
4. Hood to be all welded, minimum 18 gauge stainless steel interior and exterior.
5. Verify hood height with ceiling obstructions and ductwork prior to submittal.
6. Length and width per plan(s); verify with clearances per UMC requirements.
7. Foodservice equipment contractor to provide shop drawings for hood and enclosure for review by consultant.
8. Hood hanging height to be minimum 6’-8” AFF to bottom edge.
9. Provide insulated fascia around entire exterior of hood to finished ceiling or at min to cover brackets, light fixtures, etc., approx. 12”.
10. Provide with remote light switch.
11. Slope side style to center duct connection.
12. Final length of hood shall be verified with building “for construction” plans before release for fabrication. Provide with slope to drain on left side.
13. Ventilator to be installed at 6’-8” above finished floor. Wall brackets and hanger rods, as required, provided/installed by Food Service Equipment Contractor.
14. Provide shop drawing for review and approval prior to fabrication and installation.

Item 14: Closures And Trim
Manufacturer: Stainless Steel Fabricator
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. Provide trim and closure panels to ceiling and closures between and under hood #13; 18 ga type 304 s/s construction.
2. No exposed fasteners.
3. Provide quantity required to extend entire length of hood sections.
4. Provide closures to the finished ceiling; verify height.
5. Provide shop drawing for review and approval prior to fabrication and installation.

Item 15: Trash Can
Manufacturer: Rubbermaid
Model: Brute W/ Dolly
Acceptable Alt: Continental Commercial Products
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2 Products, Part 3 - Execution and the following:
1. BRUTE® Container, without lid, 32 gallon, 22”D round, reinforced rims, built in handles, double rimmed base, high-impact plastic construction, gray.
2. BRUTE® Dolly, 18-1/4”D x 6-5/8”H, heavy duty 3” casters, 250 lb. capacity, black.

Item 16: 3 Compartment Pot Wash Sink
Manufacturer: Advance Tabco
Model: 94-K2-24D
Acceptable Alt: Eagle Metal Masters or Custom Fabricated
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2 Products, Part 3 - Execution and the following:
1. Corner Sink, 3-compartment, (3) 20” x 20” x 12” deep bowls, with 24” left & right-hand drainboards, with 8”H backsplash, stainless steel open frame base, side crossrails, adjustable stainless steel bullet feet, 16 gauge 304 stainless steel, 71” x 71” overall, NSF.

Item 17: Pre-Rinse Faucet, Backsplash Mount
Manufacturer: Fisher
Model: 34436
Acceptable Alt: T&S Brass Bronze Works or Chicago Faucets
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2 Products, Part 3 - Execution and the following:
1. Pre-Rinse Unit, 8in. adjustable wall mount, with spring action flexible gooseneck, wall bracket, Add On-Faucet with 6in. spout.
2. Wall bracket.
3. Ultra-Spray™/PLUS Valve, with 1.15 GPM nozzle, interchangeable, brass.
4. Provide with low flow nozzle.

Item 18: Faucet, Backsplash Mount
Manufacturer: Fisher
Model: 60526
Acceptable Alt: T&S Brass Bronze Works or Chicago Faucets
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Faucet, 8” backsplash mount, with 16” swing spout, elbows, stainless steel.
2. Provide with low flow aerator.

Item 19: Drain, Lever Handle
Manufacturer: Fisher
Model: 22209
Acceptable Alt: T&S Brass & Bronze Works or Component Hardware
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Units to be installed within and as part of item #16.
2. DrainKing Waste Valve, with flat strainer, 12 GM drain rate, cast red brass body

Item 20: Wall Mounted Tank Support Shelf
Manufacturer: Stainless Steel Fabricator
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. 16 ga stainless steel top and 14 ga stainless steel angle brackets.
2. Field verify all dimensions prior to fabrication.
4. Provide shop drawing for review and approval prior to fabrication and installation.
5. For item #21.
6. 24” wide x 18” deep, 14 ga stainless steel, shelf with raised lip/turn up 1” all sides – weight of tank with water approximately 200 lbs.
7. Provide unistrut and hanger rods as required to support stand to structure above through ceiling tile.

Item 21: Repressurization Storage Tank/Pump
Manufacturer: Optipure
Model: OP350/16
Acceptable Alt: No Known Equal
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. OP350 Reverse Osmosis System, with 16 gallon atmospheric storage tank with top-mounted variable flow repressurization system and sub-micron hydrophobic air breather, 3/8” connection, up to 350 gpd, combines RO water and mineral addition, operates at line pressure, includes hose, tubing and fittings, adjustable reject flow control, dual-read digital TDS meter, sample port, built-in pressure valve, integrated system bypass valve, QTMA secondary mineral addition system, for use with espresso, coffee, tea, steamer and combi ovens (164-14416).
2. BPS-QT Feed Water Booster Pump Assembly, 3/8" feed water connection and 3/8" outlet, waterproof enclosure, includes push-to-connect fittings and tubing, for BWS350 & OP350 RO systems with low feed water pressure (164-85020).
3. Part of item #22.

Item 22: Reverse Osmosis Water Filter System
Manufacturer: Optipure
Model: OP350/16
Acceptable Alt: No Known Equal
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. OP350 Reverse Osmosis System, with 16 gallon atmospheric storage tank with top-mounted variable flow repressurization system and sub-micron hydrophobic air breather, 3/8" connection, up to 350 gpd, combines RO water and mineral addition, operates at line pressure, includes hose, tubing and fittings, adjustable reject flow control, dual-read digital TDS meter, sample port, built-in pressure valve, integrated system bypass valve, QTMA secondary mineral addition system, for use with espresso, coffee, tea, steamer and combi ovens (164-14416).
2. (3) Three each QT Replacement Cartridge, 15", 2.25 gpm, 22,500 gallon capacity, 0.5 micron particulate, reduces chlorine, taste and odor, NSF (for use with QT-1, QT-1+, QT-2, QT-2+, QT-3, BWS-QT) (300-05830).
3. (3) Three each AMS QT Membrane Replacement Cartridge, BWS-QT, OP350, BWS350, 97% rejection (204-53040) (contact factory for price).
4. (3) Three each Replacement Cartridge, 15", mineral addition, for QTMA15-1 (300-05855).
5. Inhibit Scale with ScaleX2, single, 15" (160-52101).
6. Part of item #21.

Item 23: Hand Sink, Wall Mount
Manufacturer: Advance Tabco
Model: 7-PS-66W
Acceptable Alt: Eagle Metal Masters or Custom Fabricated
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Hand Sink, wall mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, 7-3/4" high side splashes, with splash mounted faucet & wrist blades, wall bracket, NSF, cCSAus.
2. Low-flow aerator 0.5gpm, fits 55/64-27 male or 15/16-27 female thread on spout, conforms to California AB 1953.
3. P-trap, heavy duty, 1-1/2", 17 gauge.

Item 24: Not Used

Item 25: Prep Table With Sink
Manufacturer: Stainless Steel Fabricator
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. 14 ga stainless steel top, stainless steel legs and adjustable bullet feet. Open storage and areas below per details.
2. See Elevations for details.
3. Field verify all dimensions prior to fabrication.
4. Rear rail per plans.
5. One 18”x24”x15” deep sink with removable stainless steel cover. Slope drain boards to sink. Provide with 12 ga. sink bracket.
6. Provide shop drawing for review and approval prior to fabrication.
7. With marine edge.

Item 26: Faucet, Deck Mount
Manufacturer: Fisher
Model: 3313
Acceptable Alt: T&S Brass Bronze Works or Chicago Faucets
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Faucet, 8” OC deck mount, mixing valve, 12” swing spout, with 1/2” inlets.

Item 27: Drain, Lever Handle
Manufacturer: Fisher
Model: 22209
Acceptable Alt: T&S Brass & Bronze Works or Component Hardware
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Units to be installed within and as part of item #25.
2. DrainKing Waste Valve, with flat strainer, 12 GM drain rate, cast red brass body

Item 28: Not Used

Item 29: Ice Maker W/O Bin
Manufacturer: Manitowoc
Model: IYT0620A
Acceptable Alt: Scotsman
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Indigo NXT™ Series Ice Maker, cube-style, air-cooled, self-contained condenser, 22”W x 24-1/2”D x 21-1/2”H, production capacity up to 575 lb/24 hours at 70º/50º (465 lb AHRI certified at 90º/70º), DuraTech™ exterior, half dice size cubes, R410 refrigerant, NSF, cULus, CE, ENERGY STAR®.
2. Mounted on top of #30.
3. Install/coordinate with water filter system #31.

Item 30: Bin, Ice
Manufacturer: Manitowoc
Model: D420
Acceptable Alt: Scotsman
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Ice Bin, 22"W, 34"D x 50"H, with side-hinged front-opening door, side grips, AHRI certified 383 lb ice storage capacity (12.9 cu. ft.), for top-mounted ice maker, Duretech exterior, NSF.
2. Install/coordinate with ice maker item #29.
Item 31: Filter System, Icemaker  
Manufacturer: Manitowoc  
Model: AR-10000  
Acceptable Alt: Scotsman or Ice-O-Matic  
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:  
1. Arctic Pure® Primary Water Filter Assembly, includes head, shroud, hardware, mounting assembly, & (1) filter cartridge, 14,000 gallon capacity, 0-600 lbs./ice per day.  
2. Install/coordinate with ice maker item #29.

Item 32: Air Curtain, Unheated  
Manufacturer: Mars Air Systems  
Model: LPV236-1U*  
Acceptable Alt: Berner International Corporation  
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:  
1. LoPro Series 2 Air Curtain, for 36” wide door, Unheated, Obsidian Black powder coated cabinet (Standard Production Color), cETLus.  
2. Level 1 control package, line voltage, combination plunger/roller door limit switch, for instant on/off control.  
3. Finish color to be verified with Architect.  
4. Control package mounting brackets.

Item 33: Fire Suppression System  
Manufacturer: Pyrochem  
Model: Kitchen Knight II  
Acceptable Alt: Ansul  
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:  
1. Systems to meet current UL 300 Requirements.  
2. Provide system for equipment below all hoods.  
3. Systems to be installed and piped in field, pre-piping in exhaust hood not acceptable.  
4. Mechanical gas valves, size and installation location to be field verified.  
5. No exposed horizontal piping.  
6. Exposed vertical piping to be chrome plated.  
7. Food Service Equipment Contractor to provide separate, shop drawings, permit and testing. Deferred DSA approval as required.  
8. Provide four (4) additional sets of contacts at microswitch for each system.  
9. System(s) to be installed within hood mounted S/S side cabinet, per plan.  
10. Verify and provide remote Automan releases, located per electrical rough-in plan FS1.2.  
11. Start Up and testing to be provided by licensed Fire Suppression Contractor.  
12. Electrical shut offs by E.C.  
13. System to be designed to accommodate interconnection with building fire alarm system.  
14. Provide shop drawing for review and approval prior to fabrication and installation.  
15. Start Up and testing to be provided by licensed Fire Suppression Contractor.  
16. Provide with type “K” fire extinguisher – By Food Service Equipment Contractor.  
17. With remote fire pull.
Item 34: Exhaust Hood - Type 1
Manufacturer: Streivor
Model: Refer To Shop Drawing
Acceptable Alt: Gaylord or Accurex
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Air volumes and overall dimensions per manufacturer’s shop drawings provided on FS series sheets.
2. Provide trim and closures between and under hood; 18 ga type 304 s/s construction; no exposed fasteners. Provide closure at top of hood around exterior of hood to finished ceiling or at min to cover brackets, light fixtures, etc. approx. 12”.
3. 3” rear air spaces against wall and any adjacent walls; verify requirements at ceiling.
4. Hood to be all welded, minimum 18-gauge S/S interior and exterior.
5. Verify hood height with ceiling obstructions and ductwork prior to submittal.
6. Length and width per plan(s); verify with clearances per UMC requirements.
7. Do not pre-plumb hood for fire suppression system.
8. Foodservice equipment contractor to provide shop drawings for hood and enclosure for review by consultant.
9. Hood hanging height to be minimum 6′-8″ A.F.F.
10. Provide with balancing dampers option.
11. Provide for additional SS closures, as required, to adjacent walls and between hood sections.
12. Provide engineering and seismic calculations for hood hanging, deferred approval by the city inspector.
13. Hood manufacturer to provide two (2) trips to job site for commissioning.
14. Provide with remote light switches.

Item 35: Closures, Trim And Wall Flashing
Manufacturer: Stainless Steel Fabricator
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. Provide trim and closure panels to ceiling and closures between and under hood; 20 ga. type 304 s/s construction; no exposed fasteners.
2. Provide and install 20 ga. Stainless Steel wall flashing at wall 6 in. AFF to 1 in. above bottom edge of hood to both the back and left side, as noted on the FS plans and elevations.
3. No exposed fasteners – utilize channel installation method.
4. Trim with batons and t-strips.
5. Provide shop drawing for review and approval prior to fabrication and installation.
6. Provide closures to the finished ceiling; verify height.

Item 36: Not Used

Item 37: Fryer, Deep Fat, Gas
Manufacturer: Pitco
Model: SSH55 - Energy Star / L10-134
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Solstice Supreme High Efficiency Fryer, gas, 40-50lb oil capacity, full tank, solid state controls, boil out & melt cycle, drain valve interlock, matchless ignition, self-clean burner, downdraft protection, stainless steel tank, front & sides, total 80,000 BTU, ENERGY STAR®, CSA, NSF, CE.
2. Casters, 10", swivel, (each) locking.
3. Gas pressure regulator; verify requirement.
4. Gas Flex Hose w/Quick Disconnect & Restraining Device, 4’ with restraining device.
5. Basket, (2) oblong/twin size, 13-1/2" x 6-1/2" x 5-1/2" deep, long handle, regular mesh – set for each fryer.
7. Fryer Filter, mobile, low-profile design, with pump & hose assembly, 50 lb. fat cap., stainless steel, for use with all 7, 12 (floor), & 14 size fryers. (Verify requirement with tallow collection vendor).
8. Self-cleaning; with filter.
9. Provide with Filter Drawer #L10-134.

Item 38: Griddle, Heavy Duty, Gas
Manufacturer: Montague
Model: DG2424-SAT
Acceptable Alt: Jade Range
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Legend™ Heavy-Duty Griddle, gas, 24” W x 24” D cooking surface, 1” thick ground & polished steel plate, 24” deep grill area, (2) snap action thermostatic controls, safety pilot ignition, with pressure regulator, stainless steel front and sides, painted black undercoating, 4” adjustable legs, 60,000 BTU, NSF, CSA.
2. One year parts and labor warranty, std.
3. Natural gas; provide pressure regulator as required.
5. Flex connector kit, 3/4” x 3’ with restraining device.
6. Provide with gas Connector Hose, 3/4” connection, 48” long, with quick disconnect couplings, restraining device & thermal shut-off.
7. Mounted on top of item #40.
8. Provide with Automatic Pilot Re-Light.

Item 39: Broiler, Under-Fired, Gas, Counter
Manufacturer: Montague
Model: UFLCS-24R
Acceptable Alt: Jade Range
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Legend Series Char-Broiler, 24”, countertop, shallow depth low-profile, self-cleaning stainless steel radiants, 2-position cast iron Ultra-Flow reversible top grate, stainless steel front, sides & top trim, 3/4" rear gas, with pressure regulator, 4" adjustable nickel legs, 76,000 BTU, NSF, CE.
2. Natural gas; provide regulator as required.
5. Removable s/s splash guard.
6. Provide with adjustable S/S legs, to be securely mounted to the top of refrigerated drawers.
7. Provide with gas Connector Hose, 3/4” connection, 48” long, with quick disconnect couplings, restraining device & thermal shut-off.
8. Mounted on top of item #40.
Item 40: Refrigerator, Shorty
Manufacturer: True
Model: TRCB-48
Acceptable Alt: Victory or Traulsen
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Refrigerated Chef Base, 48-3/8”L, one-piece 300 series 18 gauge stainless steel top with V edge, stainless steel front/sides, aluminum back, aluminum interior with stainless steel floor, (2) drawers, eULus, UL EPH Classified, MADE IN USA
2. Self-contained refrigeration, 9 foot cord and plug.
3. Heavy gauge S/S flat top. Cooking equipment items #38-39 to be securely fastened to top.
4. 2.5” Casters (set of 4) with front set to include locking brakes.

Item 41: Range, Heavy Duty, Gas W/ Convection Oven
Manufacturer: Montague
Model: V136-5
Acceptable Alt: Jade Range
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Legend™ Heavy Duty Range, gas, 36", (6) 1 2" 30,000 BTU open burners, convection oven base, stainless steel front & 4” flue riser, black sides, 6” high adjustable stainless steel legs.

Item 42: Filler, Kettle & Pot
Manufacturer: Fisher
Model: 4230
Acceptable Alt: T&S Brass & Bronze Works or Chicago Faucets
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Pot Filler Faucet, splash-mounted mixing faucet, with 8” adjustable centers, double-joint spout, 18” long, with insulated off-on control valve at outlet, 1/2” inlets.

Item 43: Oven-Steamer, Combination, Gas, With Stand
Manufacturer: Electrolux
Model: 267753 – AOS102GTP1
Acceptable Alt: Rational or (Alto-Shaam- Boiled unit)
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. (AOS102GTP1) Air-O-Steam® Combi Oven, gas, full-size, (10) 18” x 26” full size sheet pan capacity, "TOUCHLINE" touch control panel, green cleaning functions, hinged door with (2) positions, stainless steel interior & exterior, spray hose & wash arm, includes: (5) 304 stainless steel grids (922076) & control panel filter (922247), cETLus, ETL-Sanitation.
2. Self-cleaning; mobile.
3. Install/coordinate with reverse osmosis water filter assembly items #21-22.
5. Natural gas.
6. Fat Filter.
7. Grease Collection Tray, 2-2/5”.
8. Open base with rack guides.
Item 44: Heat Lamp With Lights
Manufacturer: BSI
Model: 605 Series – Stainless Steel
Acceptable Alt: Hatco
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Stealth™ Warmer & Light Combo, cULus, NSF.
2. Switch to be located on lamp, not remote.
3. Length per plan and sized to cover hot wells/hot pads below it.
4. Housing finish to match posts of sneeze guards.

Item 45: Front Serving Counter
Manufacturer: Millwork/Solid Surface Material
Model: Custom
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. Counter to be fixed with millwork body and base consisting of ¾” furniture grade plywood. Provide with pressure treated wood base, verify/coordinate with floor sinks.
2. Millwork finish and laminate color/type for top/splashes at walls per architect’s details.
3. Field verify all dimensions prior to fabrication.
4. Size, shape and configuration per plans and field verified conditions.
5. Interior finish to be white plastic laminate, melamine not acceptable.
6. Provide heavy duty door hinges, interior adjustable shelves where shown/required. Refer to elevations and fabrication details for adjustable shelving, storage areas, cove base and false kick locations.
7. Door pull/hinge and handles per architect’s selection.
8. Provide for louvers in doors, if required.
10. FSEC/Fabricator to coordinate fabrication/installation of counter with equipment items that are to be dropped into top, roll under and be attached to/through counter.
11. FSEC/Fabricator is required to provide shop drawings for approval by consultant, prior to fabrication. Note: All fabrication drawings that are a combination of multiple fabricated or custom manufactured components/items are to be provided as one shop drawing, no exceptions. Brass Smith Sneeze guards including post locations and mounting requirements are to be combined and shown on fabrication shop drawings for all service counters. All fabrication shop drawings are to indicate equipment cut-out requirements/dimensions. Shop drawings to include multiple sections through counter/equipment/sneeze guards (provide minimum (3) three sections through all service counters).

Item 46: Sneeze Guards
Manufacturer: BSI
Model: DECO-205-N
Acceptable Alt: Custom Fabricated
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Custom configuration length per plans and field conditions.
2. Furnish all posts, glass etc. for complete lengths of sneeze guards as indicated per FS floor plans and fabrication series sheets on elevations series and required to provide adequate food protection. Provide all necessary components for a fully functional guard.
3. Sneeze guards (spaced so as not conflict or be directly in front of equipment) where required.
4. Post finish to be Stainless Steel.
5. All front/side/end glass panels to be minimum 3/8” thick tempered glass with 1” radius sides/corners.
6. Custom below counter mounting system extending support posts to base of cabinet and secured with custom flange.
7. Unit shipped knocked down. Assembly required on site by FSEC.
8. Coordinate heat lamp placement/wiring.
9. Manufactured to meet UL, NSF and local health code standards and bear appropriate insignias.
   These assemblies are custom fabricated. FSEC / Brass Smith is required to provide shop drawings for approval by consultant, prior to fabrication. All drawings to show, at a minimum in plan view, the equipment items (below) that are covered by the sneeze guard. Side views to indicate compliance with California code 54”/60” rule for sneeze protection.
10. Provide shop drawing for review and approval prior to fabrication and installation.

Item 47: Fill Faucet
Manufacturer: Fisher
Model: 58017
Acceptable Alt: T&S Brass & Bronze Works or Chicago Faucets
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2- Products, Part 3 - Execution and the following:
1. Faucet, single-deck single control, with 8” swing spout, stainless steel.

Item 48: Drop-In, Heated Shelf
Manufacturer: Hatco
Model: GRSB-48-I
Acceptable Alt: No Known Equal
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2- Products, Part 3 - Execution and the following:
1. Glo-Ray® Drop In Heated Shelf with Recessed Top, 49-1/2” x 21”, 1/2” deep recessed surface area, hardcoat aluminum top, control thermostat, illuminated on/off switch & mounting bracket, NSF, cUL, UL, UL EPH Classified, ANSI/NSF 4, CSA.
2. Units to drop into item #45, FSEC to coordinate all requirements for cut-out, etc., with fabricator.
3. Thermostat control with lighted rocker switch.

Item 49: Drop-In, Hot Wells
Manufacturer: Randell
Model: 95604-208Z
Acceptable Alt: Delfield or Wells
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2- Products, Part 3 - Execution and the following:
1. Drop-In Hot Food Unit, electric, (4) 12” x 20” pan size, wet operation, individual thermostatic controls, stainless steel top corrosion resistant steel exterior, cUL, UL, NSF, Made in USA.
2. Four (4) removable divider Bars, 20”.
3. With Drains. Drain Valve Extension Kit, extension from drain to counter front with remote handle. Drain Screen.
Item 50: Sink, Hand With Soap Dispenser, Drop-In
Manufacturer: Advance Tabco
Model: 7-PS-42
Acceptable Alt: Eagle Metal Masters or Custom Fabricated
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Recessed Hand Sink, 14"W x 10"D x 5" deep sink bowl, includes: 4" OC deck mounted gooseneck faucet with aerator, soap & paper towel dispensers, 4"H side splashes, 304 stainless steel, NSF (countertop opening not to exceed 17-3/8" (front to back) x 17-1/2" (left to right)).

Item 51: Drop-In, Hot/Cold Wells
Manufacturer: Randell
Model: 9580-3A-208Z
Acceptable Alt: Delfield or Wells
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 – Execution and the following
1. Drop-In Hot/Cold Food Unit, electric, (3) 12"x20" pan size, switch for hot or cold operation, common waterbath, thermostatic controls, stainless steel top corrosion resistant steel exterior, drain & gate valve, cUL, UL, NSF, Made in USA.
2. Self-contained air cooled refrigeration.
3. Provide Divider Bars to create 12"x20" sections.
4. Perforated Bottom Strainer Plate, 1" thick, two section – removable.
5. As part of this item provide a custom fabricated stainless steel louvered or perforated cover over lower exposed refrigeration components, sized as required to cover frame. Attached/screwed to frame body with sheet metal screws, removable for service access only.

Item 52: Slicer With Stand
Manufacturer: Hobart
Model: HS7N-1/205026 Mobile
Acceptable Alt: Berkel
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Heavy Duty Meat Slicer, automatic, 13" CleanCut™ knife, burnished finish, (3) stroke lengths & (4) stroke speeds, removable meat grip assembly, removable ring guard cover, product fence, single action top mounted sharpener with Borazon™ stones, cleaning kickstand, NSF cETLus.
2. Equipment Stand, 27"W x 32"D x 31-7/8"H, (2) undershelves, mobile on casters, front locking.

Item 53: Toaster, Conveyor
Manufacturer: Hatco
Model: TQ-400
Acceptable Alt: Toastmaster
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Toast-Qwik® Conveyor Toaster, horizontal conveyor, countertop design, all bread types toaster, approximately 6 slice capacity/min, 2" opening height, electronic controls, colorguard sensing system, cULus, UL EPH Classified, ANSI/NSF 4, Made in USA.
2. Automatic Power Save Mode.
Item 54:  Cabinet, Mobile, Warming & Holding  
Manufacturer: Alto-Shaam  
Model:  1000-UP  
Acceptable Alt: Carter Hoffmann  
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:  
1. Halo Heat® Heated Holding Cabinet, mobile, double-compartment, on/off simple control with adjustable thermostats, insulated, capacity for (8) 18" x 26" x 1" sheet pans in each compartment, heavy-duty stainless steel exterior and interior, 5" heavy-duty casters; 2 rigid, 2 swivel with brake, EcoSmart®, cULus, UL EPH ANSI/NSF 4, CE, IP X4, TUV NORD.  
2. Provide with right hand door hinging.

Item 55:  Dry Storage Shelving  
Manufacturer: Metro  
Model:  BR Series - 5 Tier  
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:  
1. Sizes, quantities and configuration per plan.  
2. 74” long posts.  
3. All Solid Shelf Plates.  
4. 36” wide shelves.  
5. 5 Tier high; independent posts, mobile with casters and brake locks.

Item 56:  Trash Counter  
Manufacturer: Millwork/Solid Surface Material  
Model:  Custom  
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:  
1. Counter to be fixed with millwork body and base consisting of ¾” furniture grade plywood.  
   Provide with pressure treated wood base.  
2. Fixed counter height at 3’-6” – see elevations.  
3. Millwork finish and laminate color/type for top/splashes at walls per architect’s details.  
4. Field verify all dimensions prior to fabrication.  
5. Size, shape and configuration per plans and field verified conditions.  
6. Interior finish to be white plastic laminate, melamine not acceptable.  
7. Provide heavy duty door hinges, interior adjustable shelves where shown/required. Refer to elevations and fabrication details for adjustable shelving, storage areas, cove base and false kick locations.  
8. Door pull/hinge and handles per architect’s selection.  
9. Provide for louvers in doors, if required.  
11. FSEC/Fabricator to coordinate fabrication/installation of counter with equipment items that are to be dropped into top, roll under and be attached to/through counter.  
12. FSEC/Fabricator is required to provide shop drawings for approval by consultant, prior to fabrication. Note: All fabrication drawings that are a combination of multiple fabricated or custom manufactured components/items are to be provided as one shop drawing, no exceptions. Brass Smith Sneeze guards including post locations and mounting requirements are to be combined and shown on fabrication shop drawings for all service counters. All fabrication shop drawings are to indicate equipment cut-out requirements/dimensions. Shop drawings to include multiple sections.
through counter/equipment/sneeze guards (provide minimum (3) three sections through all service counters).

Item 57: Mobile Condiments Counter  
Manufacturer: Millwork/Solid Surface Material  
Model: Custom  
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. Counter to be mobile with millwork body/base – millwork finish and operable doors.
2. Refer to architectural finish specifications laminate selection/grain/pattern etc.
3. Size, shape and configuration per plans and field verified conditions.
4. Field verify all dimensions prior to fabrication.
5. All furniture grade plywood construction – no melamine or particle board allowed.
6. Interior finish to be white plastic laminate, melamine not acceptable.
7. Provide with operable doors on one side at each straight section – doors sizes to match. Provide with heavy duty hinges and built-in door handles.
8. Door pull/hinge and handles per architect’s selection.
9. Mobile with heavy duty castors; outer castors to be locking.
10. FSEC/Fabricator to coordinate fabrication/installation of counter with equipment items that are to be dropped into top, roll under and be attached to/through counter.
11. One (1) Unit Future.

Item 58: Mobile POS Counter  
Manufacturer: Millwork/Solid Surface Material  
Model: Custom  
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. Counter to be mobile with millwork body/base – millwork finish and operable doors.
2. Refer to architectural finish specifications laminate selection/grain/pattern etc.
3. Size, shape and configuration per plans and field verified conditions.
4. Field verify all dimensions prior to fabrication.
5. All furniture grade plywood construction – no melamine or particle board allowed.
6. Interior finish to be white plastic laminate, melamine not acceptable.
7. Provide with operable doors on one side at each straight section – doors sizes to match. Provide with heavy duty hinges and built-in door handles.
8. Door pull/hinge and handles per architect’s selection.
9. Mobile with heavy duty castors; outer castors to be locking.
10. FSEC/Fabricator to coordinate fabrication/installation of counter with equipment items that are to be dropped into top, roll under and be attached to/through counter.
12. FSEC/Fabricator is required to provide shop drawings for approval by consultant, prior to fabrication. Note: All fabrication drawings that are a combination of multiple fabricated or custom manufactured components/items are to be provided as one shop drawing, no exceptions. Brass Smith Sneeze guards including post locations and mounting requirements are to be combined and shown on fabrication shop drawings for all service counters. All fabrication shop drawings are to indicate equipment cut-out requirements/dimensions. Shop drawings to include multiple sections through counter/equipment/sneeze guards (provide minimum (2) two sections through all service counters).
Item 59: POS Station
Manufacturer: By College District
Model: Not In Food Service Equipment Contract
Provide with data.

Item 60: Trash Can
Manufacturer: Rubbermaid
Model: 3536 (40-Gal Square Brute)
Acceptable Alt: Continental Commercial Products
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2 Products, Part 3 - Execution and the following:
1. BRUTE® Container, square, without lid, 40 gallon, 23-1/2"D x 28-3/4"H, nesting handles, rounded corners & smooth contours, plastic construction, gray, NSF, Made in USA.
2. BRUTE® #3530 Dolly, square, 17-1/4"D x 6-1/4"H, for 3526 and 3536 containers, 250 lb. capacity, black, NSF, Made in USA, non-marking casters.
3. BRUTE® #3539 Container Lid, square, 24"D x 2"H, for 3536 container, tight-fitting, gray, NSF, Made in USA.

Item 61: Refrigerated Self-Service Case
Manufacturer: Structural Concepts
Model: B42
Acceptable Alt: Federal Industries
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2 Products, Part 3 - Execution and the following:
1. Oasis® Self-Service Refrigerated Merchandiser, 45-1/2"W, high profile, open front, (4) non-lit metal shelves, LED top light, Breeze™ with EnergyWise self-contained refrigeration system, Blue Fin coated coil, one piece formed ABS plastic tub, flat header, black interior, laminate exterior, full end panels with mirror, cETLus, ETL-Sanitation.
2. Self-contained.
3. Mobile on casters.

Item 62: Ice Cream Cabinet & Freezer
Manufacturer: Nor-Lake (By Vendor)
Model: FTB31-6 (Not In Food Service Equipment Contract)

Item 63: Front Serving Counter
Manufacturer: Millwork/Stainless Steel
Model: Custom – See Architect’s Drawings
Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. Counter to be fixed with millwork body and base consisting of ¾” furniture grade plywood.
   Provide with pressure treated wood base, verify/coordinate with floor sinks.
2. Millwork finish and laminate color/type for top/splashes at walls per architect’s details.
3. Field verify all dimensions prior to fabrication.
4. Size, shape and configuration per plans and field verified conditions.
5. Interior finish to be white plastic laminate, melamine not acceptable.
6. Provide heavy duty door hinges, interior adjustable shelves where shown/required. Refer to elevations and fabrication details for adjustable shelving, storage areas, cove base and false kick locations.
7. Door pull/hinge and handles per architect’s selection.
8. Provide for louvers in doors, if required.
10. FSEC/Fabricator to coordinate fabrication/installation of counter with equipment items that are to be dropped into top, roll under and be attached to/through counter.
11. FSEC/Fabricator is required to provide shop drawings for approval by consultant, prior to fabrication. Note: All fabrication drawings that are a combination of multiple fabricated or custom manufactured components/items are to be provided as one shop drawing, no exceptions. Brass Smith Sneeze guards including post locations and mounting requirements are to be combined and shown on fabrication shop drawings for all service counters. All fabrication shop drawings are to indicate equipment cut-out requirements/dimensions. Shop drawings to include multiple sections through counter/equipment/sneeze guards (provide minimum (3) three sections through all service counters).

Item 64: Coffee Condiments
Manufacturer: By Vendor
Model: Not In Food Service Equipment Contract

Item 65: Coffee Server, Insulated
Manufacturer: Curtis (By Vendor)
Model: Not In Food Service Equipment Contract

Item 66: Refrigerated Self-Service Case
Manufacturer: By Vendor
Model: Not In Food Service Equipment Contract

Item 67: Bakery Case, Self Service, Non-Refrigerated
Manufacturer: Federal Industries
Model: WDC4276SS
Acceptable Alt: Structural Concepts

Item 68: Beverage Serving Counter
Manufacturer: Millwork/Solid Surface Material
Model: Custom – See Architect’s Drawings

Fabricate and set in place per Part 2 Products, Elevations, Details and the following:
1. Counter to be fixed with millwork body and base consisting of ¾” furniture grade plywood. Provide with pressure treated wood base, verify/coordinate with floor sinks.
2. Millwork finish and laminate color/type for top/splashes at walls per architect’s details.
3. Field verify all dimensions prior to fabrication.
4. Size, shape and configuration per plans and field verified conditions.
5. Interior finish to be white plastic laminate, melamine not acceptable.
6. Provide heavy duty door hinges, interior adjustable shelves where shown/required. Refer to elevations and fabrication details for adjustable shelving, storage areas, cove base and false kick locations.
7. Door pull/hinge and handles per architect’s selection.
8. Provide for louvers in doors, if required.
10. FSEC/Fabricator to coordinate fabrication/installation of counter with equipment items that are to be dropped into top, roll under and be attached to/through counter.
11. FSEC/Fabricator is required to provide shop drawings for approval by consultant, prior to fabrication. Note: All fabrication drawings that are a combination of multiple fabricated or custom manufactured components/items are to be provided as one shop drawing, no exceptions. Brass Smith Sneeze guards including post locations and mounting requirements are to be combined and shown on fabrication shop drawings for all service counters. All fabrication shop drawings are to indicate equipment cut-out requirements/dimensions. Shop drawings to include multiple sections through counter/equipment/sneeze guards (provide minimum (2) two sections through all service counters).

Item 69-70: Not Used

Item 71: Dispenser, Beverage/Non-Carbonated
Manufacturer: Bunn (By Vendor)
Model: JDF-2S (Not In Food Service Equipment Contract)

Item 72: Dispenser, Cup
Manufacturer: San Jamar (By Vendor)
Model: C8504WF (Not In Food Service Equipment Contract)

Item 73: Dispenser, Brewer, Tea
Manufacturer: Curtis (By Vendor)
Model: TB (Not In Food Service Equipment Contract)

Item 74: Coffee Maker, Satellite System
Manufacturer: Curtis (By Vendor)
Model: TP15T Twin (Not In Food Service Equipment Contract)

Item 75: Refrigerated Self-Service Case
Manufacturer: Structural Concepts
Model: B42
Acceptable Alt: Federal Industries
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Oasis® Self-Service Refrigerated Merchandiser, 45-1/2"W, high profile, open front, (4) non-lighted metal shelves, top light, Breeze™ with EnergyWise self-contained refrigeration system, Blue Fin coated coil, one piece formed ABS plastic tub, black interior, laminate exterior, full end panels with mirror, cETLus, ETL-Sanitation.
2. Mobile on casters.

Item 76: Dispenser, Beverage/Carbonated & Non. - With 8 Dispensing Heads
Manufacturer: Lancer (By Vendor)
Model: FS3016 (Not In Food Service Equipment Contract)
Item 77: Ice Maker W/O Bin
Manufacturer: Manitowoc
Model: IYT0420A
Acceptable Alt: Scotsman
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Indigo NXT™ Series Ice Maker, cube-style, air-cooled, self-contained condenser, 22"W x 24-1/2"D x 21-1/2"H, production capacity up to 460 lb/24 hours at 70°/50° (375 lb AHRI certified at 90°/70°), DuraTech™ exterior, half-dice size cubes, R410A, NSF, cULus, CE, ENERGY STAR®.
2. Mounted on top of #76.
3. Install/coordinate with water filter system #78.

Item 78: Filter System
Manufacturer: Everpure
Model: EV9272-24/EV9612-06/EV9607-04
Acceptable Alt: Cuno
Furnish and set in place per manufacturer’s standard specification, Part 1 – General Conditions, Part 2-Products, Part 3 - Execution and the following:
1. Everpure® Twin Series Filter Head, series plumbed, built-in water shutoff valve and flushing valve, includes mounting box bracket, corrosion resistant, 125 PSI working pressure, 3/4" inlet/outlet.
2. MC Filter Cartridge, reduces chlorine taste and odor and other offensive contaminants, NSF Certified under NSF/ANSI Standards 42 and 53, install vertically, allow 2.5” clearance below, flush cartridge for five minutes at full flow each installation time/cartridge change, rated 9,000 gallons capacity, 20.75”H x 3.25” Dia, min. 1.67 gpm service flow rate, 10-125 psi non-shock pressure required.
3. Everpure® 7SO Water Softening Cartridge, reduces scale and mineral build-up, 0.5 gpm flow rate, 2,000 grain capacity, 10-125 PSI working pressure, 35-100°F operating temperature, NSF.

Item 79: Soda System
Manufacturer: By Vendor
Model: Not In Food Service Equipment Contract

Item 80: Not Used

END OF SECTION
SECTION 11 52 00

AUDIO-VISUAL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Contractor-installation of District-furnished projector and mount.
   2. Flatscreen mounting brackets.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Section

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for flatscreen mounting brackets.

PART 2 - PRODUCTS

2.1 AUDIO-VISUAL EQUIPMENT

A. District-Furnished Projector and Mount: Short throw type, proposed model is Epson Brightlink Pro 1460Ui with Ultra short-throw wall mount V12H777020.
   1. Contractor shall coordinate installation with AV/Technical Drawings and whiteboard projection surface as specified in Section 10 11 00.

B. Flatscreen Mounting Bracket: As manufactured by Chief Manufacturing, “Model #RXT2”, or equal.

C. Blocking and Backing: As indicated on the Drawings.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate with other trade contractors affected by the work to assure work is performed in proper sequence.

B. Coordinate requirements for blocking and auxiliary structural supports to ensure adequate means for installation of equipment.

3.2 INSTALLATION

A. Install projector and mount at locations indicated and in compliance with manufacturer’s written instructions.
B. Install flatscreen mounting brackets at locations indicated and in compliance with manufacturer’s written instructions.

3.3 PROTECTING AND CLEANING

A. Protect audio-visual equipment after installation from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manually operated window shades, S-1.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

B. FS - Federal Specifications
   1. CCC-C-521e - Cloth, Coated, Window Shade.

C. NFPA - National Fire Protection Association

D. UL - Underwriters Laboratories Inc.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Shade cloth shall be constructed of a woven screen material consisting of yarns comprised of extruded vinyl coated polyester core yarn as a composite thermoplastic shade cloth that shall be sealed at the edges, assuring binding the core yarn to the coating at the cut edge to assure a sealed edge to substantially minimize raveling. Screen cloths to have inert core yarns; i.e. fiberglass shall not be acceptable.

1.4 SUBMITTALS

A. Product Data: Submit for each type of product specified. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Show location and extent of shades. Include elevations, sections, details, and dimensions not shown in product data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.

C. Samples for Initial Selection: For each colored component of each type of shade indicated.
   1. Include similar samples of accessories involving color selection.

D. Samples for Verification: Not less than 3 inches square of shade material, with specified treatments applied. Mark face of material.
E. Qualification Data: For installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for each type of shade.

G. Contract Closeout Submittals: Submit maintenance data for window treatments to include the following:
   1. Methods for maintaining treatments and finishes.
   2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance.
   3. Operating hardware.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Source Limitations: Obtain shades through 1 source from a single manufacturer.

C. Fire Test Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver and store products in cartons with seals unbroken and labels intact until time of installation.

B. Provide proper storage facilities to prevent damage.

1.7 PROJECT CONDITIONS

A. Field Measurements: Check actual dimensions by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

A. Specialty Warranty
   1. Shade fabric to be warranted for colorfastness for minimum of 25 years, regardless of color, including white.
   2. In the event of a warranted product failure, the shade contractor will, at no cost to the District, facilitate acquisition and delivery of all necessary components to the District.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

A. Acceptable Manufacturer: MechoShade Systems, Inc., “Mecho/5”, or equal.

**2.2 WINDOW SHADES**

A. Provide manually operated roller privacy shades with heavy-duty commercial grade hardware; provide double Snaploc square fascia and end caps where shades are exposed to view.

1. Sizes: As scheduled; oversized installations may require seaming running one way versus the other.
   a. Width of shade shall exceed minimum 2 inches beyond overall width of window.

B. Room Darkening Shade Material: Meet requirements of FS CCC-C-521e for fire retardancy and NFPA 701 Small Scale requirements. Antimicrobial without topical treatment. Material shall meet requirements of ASTM E84, with flame spread rating of 17 and smoke density index of 118.

1. Cloth: Smooth, as manufactured by Mecho Shade, “EcoVeil”, or equal.
   a. At North, East, and West Sides: Openness factor as indicated on the Finish Schedules, Drawing Sheet A9.13.2.
   b. At South Side: Openness factor as indicated on the Finish Schedules, Drawing Sheet A9.13.2.

2. Color: As selected by the Architect.

C. Manually Operated Shade System: Chain operated roller shade system with adjustable slip clutch.

D. Mounting: Mounting to wall with brackets where shade is mounted above wood grille ceiling. Provide with removable closure panel.

**2.3 MISCELLANEOUS MATERIALS**

A. Accessories: Provide accessories, brackets, fittings, and fastenings as necessary for proper operation and installation of shades; conceal fasteners or finish flush, painted to match exposed metal finish.

1. Mounting Brackets: Manufacturer’s standard for wall or ceiling mounting as indicated.

**2.4 FINISHES**

A. Housing: As selected by the Architect from manufacturer’s standard range of finishes.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine construction to support, adjoin or otherwise contact and verify that shade dimensions are correct, painting has been completed, setting conditions are dry, clean and otherwise proper for installation.

B. Do not install shades until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Employ mechanics skilled in installations required.

B. Adjust as required such that shades permit proper positioning over full range of movement and smooth raising and lowering without binding.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train the District’s maintenance personnel to adjust, operate, and maintain roller shades.

END OF SECTION
SECTION 12 36 61.16
SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1  SUMMARY

A. Section Includes: Solid surfacing countertops, SS-1 and SS-2.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections
   1. Section 05 50 00 - Metal Fabrications: Provision of countertop supports.
   2. Section 06 41 10 - Custom Casework: Provision of custom casework.
   3. Section 07 92 00 - Joint Sealants: Provision of sealants.

1.2  REFERENCES

A. WI - Woodwork Institute

1.3  SUBMITTALS

A. Product Data: Submit manufacturer’s product literature.

B. Shop Drawings: Show all items at large scale including methods of fabrication and construction.

C. Samples: Submit 3 solid surfacing materials, 6 inches square.

PART 2 - PRODUCTS

2.1  MATERIALS

A. Solid Surfacing, SS-1: Homogeneous mixture containing 93 percent or greater pure quartz.
   1. Thickness: 3 cm.
   2. Color: Refer to the schedule of interior finishes on Drawing Sheet A9.13.2.
   3. Product: As manufactured by Silestone, or equal.

B. Solid Surfacing, SS-2: Homogeneous mixture containing 93 percent or greater pure quartz.
   1. Thickness: 3 cm.
   2. Color: Refer to the schedule of interior finishes on Drawing Sheet A9.13.2.

C. PlywoodBacking for Countertops: Provide 1/2-inch marine plywood.

D. Sealant: As specified in Section 07 92 00.
E. Grommet: Liner and cap for 1-3/4 inch hole; satin chrome finish; as manufactured by Doug Mockett & Company, Inc.; Grainger; Electriduct, or equal.

2.3 FABRICATION

A. Quality Standard: Comply with WI Section 17D, “Decorative Synthetic Marble Countertops and Sinks”.
   1. Grade: Premium.
   2. Thickness of solid surfacing shall be constant and shall not vary.

B. Fabricate tops in 1 piece with shop-applied edges, unless otherwise indicated. Comply with solid surfacing material manufacturer’s recommendations for adhesives, sealers, fabrication, and finishing.
   1. Drill holes in countertops for grommets and other openings as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor countertops securely to support systems as indicated. Caulk space between countertop and wall with specified sealant.
   1. Install countertops with no more than 1/8-inch in 96 inch sag, bow, or other variation from a straight line.

B. Seal joints in accordance with manufacturer’s instructions.

3.2 ADJUSTING AND CLEANING

A. Remove damaged or otherwise disfigured portions and replace with new prior to the District’s acceptance.

END OF SECTION
SECTION 12 48 13

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Walk off mat and frames.

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials

B. SSPC - The Society for Protective Coatings

1.3 SYSTEM DESCRIPTION

A. Performance Requirement: Design and fabricate floor mats and frames to withstand and support the effects of a uniformly distributed gravity load of at least 300 psf.

1.4 SUBMITTALS

A. Product Data: Submit product data for each type of floor mat and frame specified. Include manufacturer’s specifications and installation instructions, details of construction relative to materials, dimensions of individual components, profiles and finishes.

B. Shop Drawings: Submit shop drawings showing layout and types of floor mats and frames, full-scale sections, details of patterns or designs, anchors and accessories.
   1. Coordinate shop drawing submittal with concrete work shop drawings showing oversized recess for deferred installation of frames.

C. Samples: Submit samples for verification in the form of 12 inch square assembled sections of floor mat and frame members. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

D. Contract Closeout Submittals: Submit maintenance data in the form of manufacturer’s printed instructions for cleaning and maintaining floor mats and frames.
1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual blocked-out openings in floors by accurate field measurements before fabricating frames and mats; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabrication without field measurements. Coordinate floor construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

1.6 SEQUENCING AND SCHEDULING

A. Provide oversized recesses in concrete work to receive mats and frames. Defer frame installations until building enclosure is completed and related interior finish work is in progress.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Matsinc, “Soft Grid”; no known equal.

2.2 MATERIALS

A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. Where not indicated, provide colors, patterns, and profiles selected by the Architect from manufacturer’s full range of products.

B. Extruded Aluminum: ASTM B221, alloy 6061-T6 or 6063-T5, T6, or T52 as standard with the manufacturer. Coat surface of frame that will contact cementitious material with bituminous coating or other protective coating recommended by the manufacturer.

C. Bituminous Coating: SSPC Paint 12, solvent type, bituminous mastic, nominally free of sulphur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.

2.3 FRAMES

A. General: Provide manufacturer’s standard frame of size and style to fit mat type and to match finish for permanent recessed installation in subfloor; complete with installation anchorages, angles, and accessories.
   1. Provide profile as indicated on the Drawings.

2.4 MATS

A. Provide manufacturer’s standard units of vinyl drop-thru panels fabricated from 100 percent pre-consumer recycled content in black.
   1. Mat Size and Transition Details: As indicated on the Drawings.
2.5 FABRICATION

A. Shop fabricate mats to greatest extent possible in sizes as indicated. Where not otherwise indicated, provide each mat as a single unit, not exceeding manufacturer’s recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes.

B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by means of straight connecting pins.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install recessed frames and mats to comply with manufacturer’s instructions at locations indicated and with top of frames and mats in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set mat tops at height for most effective cleaning action and coordinate top of mat surfaces with doors that swing across mats to provide clearance under door.

3.2 PROTECTION

A. After completing frame installations, provide temporary filler of plywood or fiberboard in mat recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near time of Substantial Completion.

END OF SECTION
SECTION 12 93 00
SITE FURNITURE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes providing site furniture complete, including but not limited to:
   1. Bike rack.
   2. Waste receptacle.
   3. Heavy-Heavy Block Seats
   4. Solid Industry Picnic Sets
   5. Rough & Ready Crosswise Top Seats

B. Related sections:
   1. Concrete for footings: Section 03 30 00.

1.2 SUBMITTALS

A. Procedures: In accordance with Section 01 33 00.

B. Submit product data, catalog cuts and manufacturer's installation instructions for items to be provided. Include manufacturer's recommendations for maintenance of items.

C. Submit shop drawings showing dimensions, finishes, framing, connection details and other information related to manufacture and installation of units.

D. Samples:

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials safely and securely, protected from weather, theft, vandalism or other damage. Prevent damage to or staining of site surfaces or other materials.

1.4 PROJECT CONDITIONS

A. Become familiar with site conditions, access and existing on-site and adjacent improvements, including utilities.

B. Protect existing improvements. Replace or repair to original condition improvements which are damaged during operations or by malfunction of installed items.

C. Field verify dimensions, grades and utility locations.
1.5 COORDINATION

A. Coordinate delivery and installation of items to be embedded in concrete work.

B. Furnish to other trades details, templates, dimensional tolerances or other information required for coordination of work.

PART 2 - PRODUCTS

2.1 MANUFACTURED ITEMS


E. Rough&Ready Crosswise Top Seats: Manufacturer Streetlife. Model R&R-CW-TOP Various options on seating lengths, see plans. Material seat untreated FSC 100% Louro Gamela hardwood. Hot dipped galvanized Steel Support. Surface Mounted; Regular Picnic Set & ADA compliant set.

F. Sizes as shown on plans. Manufacturers: See above. Color & Finishes: See above.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that adjacent work is complete and that conditions are acceptable for installation of site furniture.

3.2 LAYOUT

A. Mark locations of site furniture for review by District Representative. Adjust as directed.

B. Layout shall be accepted by District Representative before installation begins.

C. Contractor is responsible for replacement of base materials where site furniture is installed before layout is accepted.

3.3 INSTALLATION

A. Install according to manufacturer's recommendations and approved shop drawings.
B. Units shall be stable and plumb.

3.4 FINAL ACCEPTANCE

A. Protect Work from damage or theft until Final Acceptance. Repair or replace damaged work to original condition.
B. Keep site clean during construction. At Final Acceptance, site furniture shall be in place, clean and in perfect condition, ready for use.

END OF SECTION
SECTION 21 00 00

FIRE SUPPRESSION BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 21 00 00, Fire Suppression Basic Requirements applies to Division 21, Fire Suppression work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of fire protection systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:
   1. Provide: To furnish and install, complete and ready for intended use.
   2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
   3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete Item of work furnished.
   4. Or Equal: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Section 01330, Submittal Procedures, and approved by the Engineer prior to submitting bids for substituted Item.
   5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Content of Section applies to Division 21, Fire Suppression Contract Documents.

B. Related Work:
   1. Additional conditions apply to this Division including, but not limited to:
      a. Specifications
      b. Drawings
      c. Addenda
      d. Owner/Architect Agreement
      e. Owner/Contractor Agreement
      f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Section 01410, Regulatory Requirements, individual Division 21, Fire Suppression Sections and those listed in this Section.
B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
   1. State of California:
      a. CBC - California Building Code
      b. CEC - California Electrical Code
      c. CEC T24 - California Energy Code Title 24
      d. CFC - California Fire Code
      e. CMC - California Mechanical Code
      f. CPC - California Plumbing Code
      g. CSFM - California State Fire Marshal

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
   1. ABA - Architectural Barriers Act
   2. ADA - Americans with Disabilities Act
   3. AHRI - Air-Conditioning Heating & Refrigeration Institute
   4. ANSI - American National Standards Institute
   5. ASCE - American Society of Civil Engineers
   6. ASCE-7 Minimum Design Loads for Buildings and Other Structures
   7. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
   8. ASHRAE Guideline 0, the Commissioning Process
   9. ASME - American Society of Mechanical Engineers
   10. ASPE - American Society of Plumbing Engineers
   11. ASSE - American Society of Sanitary Engineering
   12. ASTM - ASTM International
   13. AWWA - American Water Works Association
   14. CFR - Code of Federal Regulations
   15. FM - FM Global
   17. IAPMO - International Association of Plumbing and Mechanical Official
   18. ICC - International Code Council
   19. IEC - International Electrotechnical Commission
   21. HI - Hydraulic Institute Standards
   22. ISO - International Organization for Standardization
   23. MSS - Manufacturers Standardization Society
   24. NEC - National Electric Code
   25. NEMA - National Electrical Manufacturers Association
   26. NFPA - National Fire Protection Association:
      a. NFPA 13 - Standard for the Installation of Sprinkler Systems
      b. NFPA 24 - Standard for Installation of Private Fire Service Mains and Their Appurtenances
      c. NFPA 25 - Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
      d. NFPA 70 - National Electrical Code
      e. NFPA 72 - National Fire Alarm and Signaling Code
   27. OSHA - Occupational Safety and Health Administration
   28. UL - Underwriters Laboratories Inc.
D. See Division 21, Fire Suppression individual Sections for additional references.

E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

F. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.4 SUBMITTALS

A. See Section 01330, Submittal Procedures as well as specific individual Division 21, Fire Suppression sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each Specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.

E. Submit shop drawings, calculations and product data sheets as one complete stand-alone package to AHJ, Owner's insurance underwriter and Engineer.

F. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 21, Fire Suppression Sections.

G. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

1. Label submittal to match numbering/references as shown in Contract Documents.

Highlight and label applicable information to individual equipment or cross out/remove
FIRE SUPPRESSION BASIC REQUIREMENTS

extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed Item. Highlight connections by/to other trades.

2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference Division 21, Fire Suppression specification Sections for specific Item required in product data submittal outside of these requirements.

3. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.

4. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.

5. See Division 21, Fire Suppression Sections for additional submittal requirements outside of these requirements.

H. Maximum of two reviews provided of complete submittal package. Arrange for additional reviews and/or early review of long-lead Item; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

I. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

J. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Structural documents.

K. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 21, Fire Suppression coordination documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety submittals.

L. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

M. Substitutions and Variation from Basis of Design:
   1. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
   2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed
under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or equal", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

N. Shop Drawings:
1. Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout, pipe layout, hanger layout, sway brace layout, seismic restraints, sway brace calculations, drains, location of drain discharge, risers, valves, details, water test information, physical device layout plans, and control wiring diagrams. Reference individual Division 21, Fire Suppression Sections for additional requirements for shop drawings outside of these requirements.
2. Shop Drawings and hydraulics calculations, sway brace calculations, trapeze hanger calculations, and the like, to be prepared under the direct supervision and control of a Professional Engineer competent to do such work and licensed in the state of California. Drawings and calculations to bear the seal and wet signature of the professional Engineer.
3. Provide Shop Drawings which indicate information required by NFPA 13. Include room names and fire sprinkler occupancy hazard classifications.
4. Provide Shop Drawings illustrating information for Hydraulic Information Sign for each hydraulic remote area calculated.
5. Utilizing the Reflected Ceiling backgrounds, provide Shop Drawings illustrating locations of fire sprinklers and piping.
6. Utilizing the Structural backgrounds, provide Shop Drawings illustrating locations and types of hangers and sway braces.
7. Provide Shop Drawings illustrating each type of hanger, including fasteners to structure.
8. Provide Shop Drawings illustrating each type of branchline restraint and sway brace, including length of sway brace member, sway brace fittings, minimum and maximum angles from vertical of sway brace member, method of attachment to structure, size, length and embedment of attachment to structure and size and type of structural member to which sway brace will be attached. Number each type of restraint and sway brace. Indicate on Drawings locations of each type of numbered restraint and sway brace.
9. Provide details for any hanger, attachment, or sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the engineered product manufacturer.
11. Shop Drawings to include a cross-sectional view that shows the sprinkler heads and piping in relation to the building's architectural and structural information. View to be chosen based on a location that will display the most information.
12. When required, provide Coordination Drawings.
13. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
14. Provide details of hanger, sway bracing and branch line restraint attachments to structure and to piping. Include details on the size and load capacities of fasteners. Provide verification of the structural capacity to withstand seismic load.
15. Provide sway bracing calculations on drawings showing horizontal seismic design load and requirements, with indication of zone of influence for each bracing location.
16. Provide a schedule of sway bracing type, size, and design criteria, including length, angle from vertical, and load capacities.
17. Clearly indicate the elevation of the highest sprinkler in relation to the elevation of the flow test pressure gauge monitor hydrant.
18. Provide details of flexible sprinkler hose fitting per manufacturer's schedule of equivalent feet used in hydraulic calculations, showing device length, maximum number of 90-degree bends and expected radius of bends.
19. Provide a schedule of signage to be installed at each flexible sprinkler hose fitting.
20. On the drawings, provide a list of number, model, temperature, sprinkler Identification number, manufacturer, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the spare sprinkler cabinet and the issue date or revision date of the list."
21. Spare sprinkler head cabinet size indicating the number of spare sprinkler heads to be contained therein.

O. Samples: Provide samples when requested by individual Sections.

P. Resubmission Requirements:
   1. Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Clearly indicate changes on Drawings and cloud changes in the submittals.
   2. Resubmit for review until review indicates no exceptions taken or make "corrections as noted".

Q. Operation and Maintenance Manuals/Owners Instructions:
   1. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or Item requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
      a. Include copies of certificates of code authority acceptance, code-required acceptance tests; test reports and certificates.
      b. Include Warranty per Section 01740, Warranties/Guaranties, Section 21 00 00, Fire Suppression Basic Requirements and individual Sections.
      c. Catalog description of each Item of equipment actually installed on job.
      d. Instructions for operation and maintenance of fire suppression systems composed of operating instructions, maintenance instructions and manufacturer's literature as follows:
         1) Testing and Maintenance Schedule Chart: Provide an 8-1/2- by 11-inch typewritten list of each item of installed equipment requiring testing inspection, lubrication or service, describing and scheduling performance of maintenance.
         2) Manufacturer's Literature: Provide copies of manufacturer's instructions for operation and maintenance of fire suppression equipment, including replacement parts list with name and address of nearest distributor. Mark each copy with equipment identification label as listed in equipment schedule, i.e. F-5 etc.
e. Include product certificates of warranties and guarantees.
f. Include Record Drawings,
g. Include copy of water supply flow test used as basis for hydraulic calculations.
h. Include hydraulic calculations and sway brace calculations.
i. Include Contractor’s Material and Test Certificates for Aboveground Piping/Underground Piping.
j. Include a copy of NFPA 25.
k. Include a copy of the list to be included in the spare sprinkler head box.
l. Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
m. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, and quantities relevant to each piece of equipment: i.e. belts, motors, lubricants, and filters.
n. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.
o. Include copy of startup and test reports specific to each piece of equipment.
p. Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

2. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 21 00 00, Fire Suppression Basic Requirements, Article titled "Demonstration".

3. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

R. Record Drawings:
1. Maintain at site at least one set of Drawings for recording “As-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical Item. Include items changed by field orders, supplemental instructions, and constructed conditions.
2. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
3. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
4. Invert elevations and dimensioned locations for water services and drainage piping below grade extending to 5-feet outside building line.
5. Record Drawings to include site information or reference site information for complete understanding of the fire protection system between the building and the point of connection to the water supply and location of flow test pressure hydrants.
6. See Division 21, Fire Suppression individual Sections for additional items to include in Record Drawings.

S. Calculations: Submit hydraulic and sway brace and the like calculations where required.

1. Hydraulic Calculations:
   a. Include friction losses between the hydraulically most remote design area and the hydrant flow test pressure hydrant.
   b. Hydraulic calculations to be performed on a nationally recognized fire sprinkler hydraulic calculation computer program, with cover sheets in the format required by the latest edition of NFPA 13. Hydraulic calculations performed “by hand” or not on a nationally recognized fire sprinkler hydraulic calculations computer program will be returned without review by engineer.
   c. Provide one or more hydraulic calculations for each hydraulically most remote area.
   d. Where it is not obvious which area is most hydraulically remote, perform and submit for review additional hydraulic calculations proving the hydraulically most remote area.
   e. For grid systems, either provide “peaked” hydraulic calculations, or provide two additional sets of hydraulic calculations for each hydraulically most remote area.
   f. Include pressure losses between the highest sprinkler and the elevation of the pressure gauge monitor hydrant of the flow test.
   g. Include friction loss for flexible branch line connectors per manufacturer's schedule of equivalent feet for device length, maximum number of bends and expected radius of bends.
   h. When flexible sprinkler hose fittings are added to an existing system, provide hydraulic calculations verifying the design flow rate will be achieved.
   i. For Future Tenant Improvement Spaces: Include in hydraulic calculations friction loss allowances for future installation of flexible sprinkler head connectors so that flexible connectors may be installed in the future without revisions to the overhead system.

2. Sway Brace Calculations:
   a. Sway brace calculations utilizing a proprietary computer calculation program only used for the sway brace components supported by that manufacturer. For example, only “manufacturer X” sway brace components, and not those of another manufacturer, may be calculated on a "manufacturer X” sway brace computer calculation program.
   b. Provide seismic calculations for any sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the I-joist manufacturer.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State, Federal and other applicable laws and regulations.

B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every Item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space.
Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

E. Provide products that are UL listed, ETL, FM, ICC-ES, and CSFM approved

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Section 01740, Warranties/Guaranties, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Section 01740, Warranties/Guaranties. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, fire alarm, plumbing, cable trays, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, electrical, fire alarm ceiling suspension and tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling and finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Section 01311, Project Management and Coordination, and/or Division 23, HVAC to combine information furnished by other trades onto master coordination documents.

B. Prepare Drawings as follows:
   1. Provide drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
   2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
   3. Indicate fire protection system piping including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
   4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible item. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings, architectural reflected ceiling drawings and HVAC equipment, ductwork and piping. Drawings to indicate proposed and identified structural
members to which hangers and sway braces will be attached as shown on structural drawings.

5. Incorporate Addenda Item and change orders.
6. Provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide like Item from one manufacturer, including but not limited to sprinkler heads, pipe, fittings, hangers and bracing materials.

2.2 MATERIALS

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL, ETL, FM, ICC-ES, and CSFM approved for their intended fire protection function or have adequate approval or be acceptable by State, County, and City authorities.

B. Articles, fixtures and equipment of a kind to be standard product of one manufacturer.

C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

D. Hazardous Materials:
   1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
   2. Comply with Section 01412, Hazardous Materials, for this project relating to hazardous materials.
   3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A., Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
B. Install equipment requiring access (i.e. drains, control operators, valves, motors, engines, pumps, controllers, air compressors, gauges, fill cups, tanks, cleanouts and the like) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:
   1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with the following:
      a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions specified. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
      b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
      c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:
   1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.
   2. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM International E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:
   1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating coordinating installation of piping systems.
   2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums: Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.
3.2 **SEISMIC CONTROL**

A. Confirm Seismic Control requirements in Structural documents, and individual Division 21, Fire Suppression Sections.

B. Provide fire suppression equipment and piping, both hanging and base mounted, with mounting connection points of sufficient strength to resist lateral seismic forces equal to lateral seismic forces as determined by building code and NFPA 13 calculations, whichever is more demanding.

C. See Structural Drawings for seismic design criteria for sway bracing and seismic restraint.

D. Earthquake resistant designs for Fire Protection (Division 21) equipment and distribution, i.e. fire sprinkler systems, fire standpipe systems, fire pumps, fire pump controllers, fire tanks, clean agent fire suppression systems, etc. to conform to regulations of jurisdiction having authority.

E. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

F. Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for piping, equipment, tanks, pumps controllers and the like. Submit shop drawings along with equipment submittals.

G. Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

H. Provide details of flexible drops for sprinklers in conformance with Building Code and ASCE 7 requirements of ceilings. Coordinate with Architectural and Structural Drawings and Specifications.

I. Piping: Per NFPA 13, ASCE-7 and local requirements.

J. Equipment:
   2. Provide means to prohibit excessive motion of fire protection equipment during an earthquake.

3.3 **REVIEW AND OBSERVATION**

A. Confirm Review and Observation requirements in Section 01400, Quality Control Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
   1. Underground piping installation prior to backfilling.
   2. Prior to covering walls.
   3. Prior to ceiling cover/installation.
   4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
   5. When mains or branchlines are to be permanently concealed by construction or insulation systems.
   6. When fire suppression systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Section 01730, Cutting and Patching, and individual Division 21, Fire Suppression Sections and the following:
   1. Cutting and patching performed under Division 21, Fire Suppression includes, but is not limited to:
      a. Cutting and patching of plaster or partitions.
      b. Cutting and patching of finished ceilings.
   2. Perform cutting and patching by skilled craftsmen in trade of work to be performed. Fill holes which are cut oversized for completed work. Match refinished areas with existing adjacent finish in a manner acceptable to Architect.
   3. When masonry or concrete construction must be penetrated, provide a steel pipe sleeve in opening and grout in place in a neat manner. Leave grout surface to match existing finish. Provide escutcheons. If sleeves are not provided, core drill penetrations.
   4. Locate concealed utilities to eliminate possible service interruption or damage.
   5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.
   6. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
   7. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
8. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

9. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, landscaping, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

10. Repair mutilation of building around pipes, equipment, hangers, and braces.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing at no additional cost to Owner.

3.6 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Section 00700, General Conditions. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Handle materials delivered to project site with care to avoid damage and deterioration. Store materials in original containers which identify manufacturer, name, brand and model numbers on site inside building or protected from weather, sun, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3. Protect bright finished shafts, bearing housings and similar Item until in service.

3.7 DEMONSTRATION

A. Confirm Demonstration requirements in Section 01770, Contract Closeout Procedures, Articles 1.12, 1.13, and 1.14, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Section 01770, Contract Closeout Procedures, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with
requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

D. Prior to acceptance of work and during time designated by Architect, provide necessary qualified personnel to operate system for a period of two hours.

E. Instruct the Owner in the operation of the sprinkler system, including main valve position (open or closed) recognition, system drainage, system testing, dry pipe valve reset and the relation to the fire alarm system.

F. Upon completion of work and adjustment of equipment, test systems to demonstrate to Owner's Representative and Architect that equipment is furnished and installed or connected under provisions of these Specifications.

3.8 CLEANING

A. Confirm Cleaning requirements in Section 01710, Cleaning Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Upon completion of installation, except for sprinklers, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

C. Sprinklers may not be cleaned except for vacuuming in a manner in which no part of the sprinkler is touched by the vacuuming equipment. Replace sprinklers which bear traces of foreign substances with sprinklers of same model, temperature, K-factor, orifice, finish, style, orientation, and the like.

3.9 INSTALLATION

A. Confirm Installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start-up equipment, in accordance with manufacturer's start-up instructions, in the presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment. Provide pump impellers to obtain Basis of Design design capacities.

D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.10 PAINTING

A. Confirm requirements in Division 09, Finishes. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Ferrous Metal: After completion of fire protection work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods,
equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.

2. After acceptance by Authority Having Jurisdiction (AHJ), in a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

3. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

4. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.

5. Covers: Covers such as vault covers and the like will be furnished with finishes which resist corrosion and rust.

### 3.11 ACCEPTANCE

A. Confirm requirements in Section 01770, Contract Closeout Procedures. In absence of specific requirements, comply with individual Sections in Division 21, Fire Suppression and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
   b. Cleaning
   c. Operation and Maintenance Manuals
   d. Training of Operating Personnel
   e. Record Drawings
   f. Warranty and Guaranty Certificates
   g. Start-up/Test Document and Commissioning Reports
   h. Letter of Conformance

### 3.12 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Upon completion of installation of equipment, sprinklers, hose valves and piping and after units are water pressurized, test system to demonstrate capability and compliance with requirements. When possible, correct malfunctioning Item at site, then retest to demonstrate compliance; otherwise remove and replace with new Item and proceed with retesting.

C. Inspect each installed Item for damage to finish. If feasible, restore and match finish to original, except fire sprinklers, at site; otherwise, remove Item and replace with new Item. Feasibility and match to be judged by Architect. Remove cracked or dented Item and replace with new Item.
D. Fire sprinklers may not be reused, or cleaned, except for dusting. Replace damaged, field painted, oversprayed, overcoated or field coated sprinklers with new sprinklers of same manufacturer, model, finish, K-factor and performance characteristics. Where identical replacement sprinklers are not available, provide sprinklers of similar finish, style, K-factor and performance characteristics.

3.13 LETTER OF CONFORMANCE

A. Provide Letter of Conformance and copies of manufacturers' warranties and extended warranties with a statement that fire suppression items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.14 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize fire protection equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

3.15 CONNECTIONS TO EXISTING

A. Prior to connection of piping to existing piping or utilities, field verify existing conditions and exact sizes and locations of existing piping. Provide additional offsets, transitions, joints, cut-ins, and replace portions of existing as required to facilitate connections of new.

END OF SECTION
SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Buried Ductile Iron Pipe and Fittings
   2. Buried PVC (Polyvinyl Chloride) Pipe and Fittings
   3. Buried Stainless Steel Pipe
   4. Joint Restraints
   5. Aboveground Black Steel Pipe and Fittings
   6. Wall and Floor Penetrations and Sleeves
   7. Switches, Valve Supervisory
   8. Switches, Water Detector
   9. Hangers and Supports
  10. Struts and Strut Clamps
  11. Sway Braces and Restraints
  12. Anchors and Attachments
  13. Gauges
  14. Bells
  15. Fire Department Connection
  16. Valves
  17. Post Indicator Valve Assemblies
  18. Backflow Prevention Devices
  19. Pipe, Valve, and Fire Protection Equipment Identification
  20. Signs
  21. Drains

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression apply to this Section.

B. In addition, reference the following:
   1. Division 22, Plumbing
   2. Division 23, Heating, Ventilating and Air Conditioning
   3. Division 26, Electrical
   4. Division 28, Electronic Safety
   5. Division 31, Earthwork
   6. Section 21 00 00, Fire Suppression Basic Requirements
   7. Section 21 13 00, Fire Suppression Sprinkler Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Submittal 01330, Submittal Procedures.

B. Provide seismic calculations for any sway brace to be attached to any I-joist according to the specifications of the I-joist manufacturer.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   2. Provide per AHJ requirements.
   3. References to product Specifications for materials are listed according to accepted ANSI, ASTM, ASME, AWWA and other base standards. Materials to meet latest approved versions of these standards.
   4. See Section 21 00 00, Fire Suppression Basic Requirements where piping materials are approved for use.
   5. Fire Suppression Screw-Thread Connections: Comply with local fire department/fire marshal regulations for sizes, threading and arrangement of connections for fire department equipment to fire department connections.
   6. Manufacturers: Unless an item is marked "No substitutions", submit substitution request for materials of other than named manufacturers.
   7. Noise and Vibration:
      a. Install vibration isolators and measures required to prevent noise and vibration from being transmitted to occupied areas. Select equipment to operate within noise coefficient (NC) design level for particular type of installation in relation to its location.
      b. After installation, make proper adjustments to reduce noise and vibration to acceptable levels as defined by Architect.
      c. In acoustically sensitive areas, design system in a manner that minimizes the number of wall penetrations.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Section 01740, Warranties/Guaranties.
1.7 FLOW TEST

A. Flow test information is provided for design of NFPA 13 sprinkler and/or NFPA 14 standpipe systems if conducted within 12 months prior to working plan submittal. If information below is older than 12 months, then information below is advisory only and not to be used for design. Provide materials and labor for a new water supply test on the closest nearby fire hydrants per NFPA 13 and NFPA 291, if test information below is older than 12 months. Base hydraulic calculations on new flow test.

B. Flow Test:
1. Flow: 3000 GPM at a residual pressure of 80 PSI.
2. Static Pressure: 100 PSI.
3. Location: DVC, San Ramon, 1690 Watermill Rd.
4. Date: 09/04/2018.
5. Information Provided By: Dublin San Ramon Services District.

1.8 SYSTEM IMPAIRMENT

A. When returning a water-based fire protection system to service after impairment or control valve closure, verify the system is in working order by performing a main drain test per NFPA 25.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Buried Ductile Iron Pipe and Fittings:
1. American Cast Iron Pipe Company
2. Atlantic States Cast Iron Pipe Company
3. Clow Water Systems Company
4. Griffin Pipe Products Company
5. McWane Cast Iron Pipe Company
6. Pacific States Cast Iron Pipe Company
7. United States Pipe & Foundry Company
8. Star Pipe Products
9. Tyler Union
10. Or equal.

B. Buried PVC (Polyvinyl Chloride) Pipe and Fittings:
1. Certainteed Corporation
2. JM Eagle
3. National Pipe and Plastics Incorporated
4. Or equal.

C. Buried Stainless Steel Pipe:
1. In Building Riser:
   a. Ames
   b. Or equal.
D. Joint Restraints:
   1. Star Pipe Products
   2. Tyler Pipe Company
   3. EBAA Iron, Incorporated
   4. Uni-Flange Corporation
   5. Union Foundry Company
   6. United States Pipe and Foundry Company
   7. Or equal.

E. Aboveground Black Steel Pipe and Fittings:
   1. Pipe:
      a. Bull Moose Tube
      b. Or equal.
   2. Fittings, Mechanical and Grooved Couplings:
      a. Victaulic
      b. Or equal.
   3. Fittings, Threaded:
      a. Anvil International
      b. Or equal.
   4. Fittings, Rubber Gasketed:
      a. Victaulic
      b. Or equal.
   5. Fittings, Welded:
      a. Anvil International
      b. Or equal.
   6. Fittings, Flanged:
      a. Victaulic; Groove/Flange Adapter.
      b. Or equal.

F. Wall and Floor Penetrations and Sleeves:
   1. Allied Rubber and Gasket Company, Incorporated, dba ARGCO
   2. Fire Protection Products Incorporated (FPPI)
   3. Or equal.

G. Switches, Valve Supervisory:
   1. Outside Screw and Yoke Valve Supervisory Switch:
      a. Potter Electric Signal Company
      b. Or equal.
   2. Post Indicator Valve (PIV) Control Valve Supervisory Switch:
      a. Potter Electric Signal Company
      b. Or equal.
   3. Non-Rising Stem Valve Supervisory Switch:
      a. Potter Electric Signal Company
      b. Or equal.
   4. Ball Valve Supervisory Switch:
      a. Potter Electric Signal Company
      b. Or equal.
5. Angle Valve Supervisory Switch:
   a. System Sensor
   b. Or equal.

H. Switches, Water Detector:
   1. Water Flow Switches; Wet Sprinkler Systems:
      a. Potter Electric Signal Company
      b. Or equal.
   2. Pressure Operated Alarm Switches; Wet Alarm Check Valve:
      a. Potter Electric Signal Company
      b. Or equal.

I. Hangers and Supports:
   1. Cooper B-Line Tolco
   3. Anvil International
   4. ITW Buildex Sammys
   5. Erico International
   6. PHD Manufacturing Incorporated
   7. Or equal.

J. Struts and Strut Clamps:
   1. Cooper B-Line Tolco
   2. Or equal.

K. Sway Braces and Restraints:
   1. Cooper B-Line Tolco
   3. Anvil International
   4. Erico International
   5. PHD Manufacturing Incorporated
   6. Or equal.

L. Anchors and Attachments:
   1. Concrete:
      a. Cast-In Place Anchors for Hangers:
         1) Cooper B-Line Tolco
         2) Automatic Fire Control Incorporated, dba Afcon.
         3) Erico International
         4) Or equal.
      b. Cast-In Place Anchors for Braces:
         1) Cooper B-Line Tolco
         2) Anvil International
         3) Automatic Fire Control Incorporated, dba Afcon.
         4) Erico International
         5) Or equal.
      c. Attachments as specified or described by structural. If not specified or described
         by structural, then as follows:
1) Hilti
2) Powers
3) Simpson Strong-Tie
4) Or equal.

2. Wood:
   a. Cooper B-Line Tolco
   b. Automatic Fire Control Incorporated, dba Afcon.
   c. Anvil International
   d. Erico International
   e. ITW Buildex Sammys
   f. Or equal.

3. Steel:
   a. Cooper B-Line Tolco
   b. Automatic Fire Control Incorporated, dba Afcon.
   c. Anvil International
   d. Erico International
   e. ITW Buildex Sammys
   f. Or equal.

M. Gauges:
   1. Ashcroft
   2. US Gauge
   3. Brecco
   4. Reliable Automatic Sprinkler Company
   5. Fire Protection Products, Incorporated (FPPI)
   6. Allied Rubber and Gasket Company Incorporated, dba ARGCO
   7. Wika Instrument Corporation
   8. Or equal.

N. Bells; Interior/Exterior Alarm Bells:
   1. Potter
   2. System Sensor
   3. Or equal.

O. Fire Department Connection:
   1. Guardian Fire Equipment
   2. Fire End Croker Corporation
   3. Potter-Roemer
   4. Elkhart Brass
   5. Tyco Fire & Building Products
   6. Or equal.

P. Valves:
   1. OS&Y Gate:
      a. 175 PSI:
         1) Nibco
         2) Mueller
         3) Or equal.
b. 250 PSI:
  1) Victaulic
  2) Or equal.

c. 350 PSI:
  1) Nibco
  2) Or equal.

d. 2-inches and Smaller:
  1) Nibco
  2) Or equal.

2. NRS Gate:
   a. 175 PSI:
      1) Nibco
      2) Or equal.
   b. 200 PSI:
      1) Mueller
      2) Or equal.
   c. 250 PSI:
      1) Victaulic
      2) Or equal.

3. Swing Check:
   a. Victaulic
   b. Nibco
   c. Mueller
   d. Viking
   e. Tyco
   f. AnvilStar
   g. Or equal.

4. Wafer Check:
   a. Nibco
   b. Mueller
   c. Viking
   d. Tyco
   e. Or equal.

5. Butterfly Valves:
   a. Victaulic
   b. Nibco
   c. Tyco
   d. Use lug body next to pumps; Nibco
   e. Or equal.

6. Pressure Reducing:
   a. Cla-Val
   b. Tyco
   c. Bermad
   d. Or equal.

7. Pressure Relief:
   a. Watts
   b. United Brass Works
   c. AGF
d. Or equal.

8. Automatic Ball Drip Drain Valve:
   a. Tyco
   b. Reliable Automatic Sprinkler Company
   c. Or equal.

9. Solenoid Valve:
   a. Burkert
   b. Or equal.

10. Three-Way Gauge Valve:
    a. Fire Protection Products Incorporated (FPPI)
    b. AGF Manufacturing Inc.
    c. Nibco
    d. Or equal.

11. Automatic Air Release Valve:
    a. Potter Electric Signal Company
    b. Or equal.

12. Ball Valve:
    a. Victaulic
    b. Apollo Valves
    c. Fire Protection Products Incorporated (FPPI)
    d. Nibco
    e. Or equal.

Q. Post Indicator Valve Assemblies:
   1. Vertical Indicator Post for Non-Rising Stem Valve:
      a. Nibco
      b. Kennedy Valve
      c. Mueller
      d. Viking
      e. United Water Products
      f. Or equal.

2. Butterfly Valve Indicator Post Assemblies:
   a. Buried lug/wafer butterfly valve and above grade traveling-nut indicator actuator.
      Internal supervisory switch. Fail safe spring on post.
      1) Nibco
      2) Henry Pratt Company
      3) Or equal.
   b. Grooved butterfly valve with internal supervisory switch, steel wall plate, wall
      post assembly.
      1) Nibco
      2) Or equal.

R. Backflow Prevention Devices; Double Check Valve Assembly:
   1. Ames
   2. Febco
   3. Zurn Wilkins
   4. Apollo Valves
   5. Or equal.
S. Pipe, Valve, and Fire Protection Equipment Identification:
   1. Fire Protection Products, Incorporated (FPPI)
   2. Allied Rubber and Gasket Company, Incorporated, dba ARGCO
   3. Or equal.

T. Signs:
   1. Tyco Fire Products
   2. Reliable Automatic Sprinkler
   3. Viking Corporation
   4. Allied Rubber and Gasket Company, Incorporated, dba ARGCO
   5. Or equal.

U. Drains:
   1. Reference Aboveground Black Steel Pipe and Fittings.
   2. AGF
   3. Victaulic
   4. Or equal.

2.2 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Pipe:
   1. Thickness: Class 52 ductile iron, AWWA C151.
   2. Pressure: 150 psi or 10.34 bar.
   3. Cement mortar lined, factory encased with 8 mil polyethylene tube or sheet or seal coat per AWWA C104.


C. Fittings restrained with thrust blocks per NFPA 24.

D. Underground Valves: Factory coated with powdered epoxy or equivalent corrosion-resistant coating. Bolts coated with bitumastic in the field. Encase the entire valve in 8-mil polyethylene bag in accordance with AWWA C-105.

2.3 BURIED PVC (POLYVINYL CHLORIDE) PIPE AND FITTINGS

A. Pipe: SDR-18, AWWA C900.

B. Fittings:
   1. AWWA C907, CSA B137.2.
   2. PVC fittings restrained with thrust blocks per NFPA 24.
4. Underground Valves: Factory coated with powdered epoxy or equivalent corrosion resistant coating. Bolts coated with bitumastic in the field. Encase the entire valve in 8-mil polyethylene bag in accordance with AWWA C-105.

C. Install tracer wire on all non-metallic underground water lines. Type R.H.W., #10 A.W.G. stranded.

2.4 BURIED STAINLESS STEEL PIPE

A. Single extended 90 degree fitting of fabricated stainless steel tubing, maximum working pressure 200 PSI. Grooved-end connection on building outlet side and CISPI coupler on underground inlet side.

2.5 JOINT RESTRAINTS

A. Mechanical joint wedge action for ductile iron pipe.


C. Wedges: Ductile iron.

D. Full restraint pressure rating of pipe with minimum safety factor of 2:1.

2.6 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

A. Wet Pipe Systems:
   1. Pipe Size 2-inch Diameter and Smaller: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 40 or minimum Corrosion Resistance Ratio (CRR) of 1.00 per UL Listing or FM Global Approval.
   2. Pipe Size 2-1/2-inch Diameter and Larger: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 10 or minimum CRR of 1.00 per UL Listing or FM Global approval. Wall thickness greater than Schedule 5. Schedule 5 not approved.

B. Joints:
   1. Threaded, flanged or bevel welded.
   2. Piping installed in plenums or shafts to have welded joints.

C. Fittings:
   1. Threaded:
      a. Malleable Iron: Class 150 and Class 300, ANSI B16.3.
      b. Cast Iron: Class 125 and 250, ANSI B16.3.
   2. Flanged:
      a. Cast iron; Class 125 and 250, ASME B16.1.
      b. Raised ground face, bolt holes spot faced.
   3. Welded:
      a. Carbon Steel: Long radius, standard weight or extra strong.
e. Steel Pipe Flanges and Flanged Fittings: ASME B16.5.
f. Forged Steel Fittings, Socket Welded and Threaded: ASME B16.11.

4. Mechanical Fittings and Grooved Couplings:
   a. Couplings: UL 213, AWWA C606, ASTM A536 ductile iron or ASTM A47 malleable iron, with enamel finish and grooves or shoulders designed to accept grooved couplings. Synthetic-rubber gasket with central-cavity, pressure-responsive design and ASTM A183 carbon-steel bolts and nuts.
   b. FM Global approved.

D. Anti-Microbial Coating: Factory-applied coating to inhibit corrosion from microbiological organisms.

2.7 WALL AND FLOOR PENETRATIONS AND SLEEVES

A. Below Grade and High Water Table Areas: Waterproof elastomeric compound.

2.8 SWITCHES, VALVE SUPERVISING

A. Provide to mount on applicable, compatible valve (OS&Y gate, or PIV), with SPDT switches to match requirements of fire alarm system. Provide with cover tamper switch where required by AHJ.

2.9 SWITCHES, WATER DETECTOR

A. Provide with cover tamper switch where required by AHJ.

B. Water Flow Switches:
   1. Vane-type; SPDT switches; electronic retard, adjustable time delay (0 to 75 seconds).
   2. Wet Sprinkler Systems, NFPA 13: 450 PSI, 18-feet per second, 4-10 gpm.

C. Pressure Operated Alarm Switches: Pressure actuated with SPDT electrical switches and adjustable time delay (0 to 75 seconds).

2.10 HANGERS AND SUPPORTS

A. General: Select size of hangers and supports to exactly fit pipe size for bare piping.

B. Hangers: Ferrous.

C. Hanger Rods:
   1. Concealed Spaces: Continuously threaded or threaded ends.
   2. Exposed Spaces: Threaded ends.

D. Finishes: Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

E. Materials:
   1. Use carbon steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.
2. Use stainless steel hangers, rods and attachments for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.

F. Anti-Scratch Padding: Use padded hangers for piping subject to scratching.

2.11 STRUTS AND STRUT CLAMPS

A. Electro-galvanized steel.
B. Designed for supporting pipe runs from strut supports.
C. UL listed for pipe up to 8-inches in diameter.
D. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.

2.12 SWAY BRACES AND RESTRAINTS

A. Sway Bracing: From a single manufacturer and compatible with sway brace calculation program.
B. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries, and the like.

2.13 ANCHORS AND ATTACHMENTS

A. General: Anchor supports to masonry, concrete and block walls per anchoring system manufacturer’s recommendations, or as modified by project Structural Engineer.
B. Materials:
   1. Ferrous.
   2. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries, and the like.
C. Cast in Place Anchors for Hangers: Verify listing is for hangers, braces, or both.
D. Attachments in Concrete:
   1. Suitable for hanging and bracing fire protection systems in concrete which is subject to cracking in a seismic event.
   2. Seismic Design Areas C, D, E and F:

b. All models of Hilti HDI and ITW Red Head Multi-Set II anchors are not approved for attaching fire protection systems in Seismic Design Areas C, D, E and F. No Exceptions.

E. ITW Buildex Sammys with FM Approval only are not allowed in certain seismic zones. Verify with FM that FM Approval is effective in project’s seismic zone.

2.14 GAUGES
A. Pressure Gauges: 3.5-inch, dial type, bronze bourdon tube or spring type, stainless steel case. 0 to 300 PSI.

2.15 BELLS
A. Exterior Alarm Bells: Minimum weatherproof backbox, typical 90 dBA at 10-feet.

2.16 FIRE DEPARTMENT CONNECTION
A. General:
   1. Thread to match fire department hardware; automatic drip connected to drain; threaded dust cap and chain of same material and finish as body.
   2. Provide with individual clappers.

B. Type: Free-Standing Type

C. Finish: Ductile Iron

D. Inlet Size: 2-1/2-inch.

E. Number of Inlets: Two.

F. Outlet Size: 4-inch.

G. Size of Pipe between Fire Department Connection and Sprinkler System: 4-inch.

H. Drain: 3/4-inch automatic ball drip, to outside.

I. Sign: Auto Sprinkler Fire Department Connection.

2.17 VALVES
A. OS&Y Gate:
   1. 2-1/2-inches and Larger: Iron body.
   2. 2-inches and Smaller: Bronze body.

B. NRS Gate:
   1. Iron body. Non-rising stem with indicator post.

C. Swing Check: Iron body, rubber and bronze faced checks.

D. Wafer Check: Iron body, rubber seat, spring actuated.

E. Butterfly Valves: Ductile iron body with factory-installed tamper switches. Use lug body next to pumps.


G. Pressure Relief: Bronze body, stainless steel spring.

H. Automatic Ball Drip Drain Valve: Bronze, spring-type.

I. Solenoid Valve: Direct-acting. Brass body with stainless steel seat. Duty cycle, 100 percent continuous with mounting bracket and screws, with cable plug.

J. Three-Way Gauge Valve: Brass; rated to 300 psi.

K. Automatic Air-Release Valve for Wet Systems:
   1. Rated to 175 psi.
   2. Automatic float-type with shutoff mounted in a water retention pan.
   3. Single set 24VAC@2A for electronic supervision.
   4. Ball valve switch with cover tamper.

L. Ball Valves: Brass body, brass stem; forged brass ball disc.

2.18 POST INDICATOR VALVE ASSEMBLIES

A. Vertical Indicator Post for Non-Rising Stem Valve:
   1. Indicates if valve is in open or shut position.
   2. Telescoping barrel type.
   3. Fixed length type.
   4. Flanged base.
   5. Mount for padlock.

B. Butterfly Valve Indicator Post Assemblies: Grooved butterfly valve with internal supervisory switch, steel wall plate, wall post assembly.

2.19 BACKFLOW PREVENTION DEVICES

A. Double Check Valve Assembly:
   1. Two check valves in series with OS&Y gate valves at each end.
   2. Provide detector if required by local utility.
   3. UL listed or FM Global Approved for fire suppression service as an assembly.
   4. Approved by local and state authorities, including project’s State Department of Health for the position in which it is installed.
2.20 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.

B. Corrosion-resistant chain or permanent adhesive.

2.21 SIGNS

A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.

B. Corrosion-resistant chain or permanent adhesive.

2.22 DRAINS

A. Reference Aboveground Black Steel Pipe and Fittings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in conformance with UL Listing, FM Approval or ICC-ES requirements and restrictions.

3.2 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Pipe Sleeves:
   1. Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
   2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor.
   3. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations.

B. Buried Pipe:
   1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
   2. Excavation and Backfill:
      a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
      b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
      c. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of a testing laboratory.
      d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material
consisting of placed crushed rock may be used as backfill above "Pipe Zone."
Remove and dispose off site native excavation material at no expense to Owner.
Adequate width of trench for proper installation of piping or conduit.

**e. Support Foundations:**
1) Foundations: Excavate trenches located in unstable ground areas below
elevation required for installation of piping to a depth which is determined
by Architect as appropriate for conditions encountered. Place and compact
approved foundation material in excavation up to "Bedding Zone."
Dewatering, placement, compaction and disposal of excavated materials to
conform to requirements contained in other Sections of Specifications or
Drawings.

2) Over-Excavations: Where trench excavation exceeds required depths,
provide, place and compact suitable bedding material to proper grade or
elevation at no additional cost to Owner.

3) Foundation Material: Where native material has been removed, place and
compact necessary foundation material to form a base for replacement of
required thickness of bedding material.

4) Bedding Material: Fill bed site with sand, pea gravel or 3/4-inch minus
crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on
leveled trench bottom for this purpose. Remove bedding to necessary depth
for piping bells and couplings to maintain contact of pipe on bedding for its
entire length. Provide additional bedding in excessively wet, unstable, or
solid rock trench bottom conditions as required to provide a firm foundation.

**f. Backfilling:**
1) Following installation and successful completion of required tests, backfill
piping in lifts.
   a) In "Pipe Zone," place backfill material and compact in lifts not to
      exceed 6-inches in depth to a height of 12-inches above top of pipe.
      Place backfill material to obtain contact with entire periphery of pipe,
      without disturbing or displacing pipe.
   b) Place and compact backfill above "Pipe Zone" in layers not to exceed
      12-inches in depth.

2) Backfill Material:
   a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand
      or pea gravel.
   b) Crushed rock, fill sand or other backfill material approved elsewhere
      in Specifications may be used above "Pipe Zone."

**g. Compaction of Trench Backfill:**
1) Where compaction of trench backfill material is required, use one of
   following methods or combination thereof:
   a) Mechanical tamper,
   b) Vibratory compacter, or
   c) Other approved methods appropriate to conditions encountered.

2) Architect to have right to change methods and limits to better accommodate
   field conditions. Compaction sufficient to attain 95 percent of maximum
density at optimum moisture content unless noted otherwise on Drawings or
elsewhere in Specifications. Water "puddling" or "washing" is prohibited.
3.3 **BURIED PVC (POLYVINYL CHLORIDE) PIPE AND FITTINGS**

A. Securely fasten tracer wire to top of water line and place along the outside of transition to ductile iron pipe with one foot of slack placed adjacent to ductile iron pipe.

B. Buried Pipe:
   1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
   2. Excavation and Backfill:
      a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
      b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
      c. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of a testing laboratory.
      d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Owner. Adequate width of trench for proper installation of piping or conduit.
      e. Support Foundations:
         1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
         2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.
         3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
         4) Bedding Material: Fill bed site with sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.
   f. Backfilling:
      1) Following installation and successful completion of required tests, backfill piping in lifts.
a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.

b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.

2) Backfill Material:
   a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
   b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:
   1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:
      a) Mechanical tamper,
      b) Vibratory compacter, or
      c) Other approved methods appropriate to conditions encountered.
   2) Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

3.4 BURIED STAINLESS STEEL PIPE

A. Underground Steel Piping Corrosion Protection: Factory wrap uninsulated underground stainless steel piping systems with protective coating composed of a coal-tar saturated wrapping tape over a 20 mil thick coal-tar epoxy coating, equivalent to "Republic X-Tru-Coat." Wrap joints spirally with a minimum overlap of 1/2 tape width. Extend wrap not less than 3-inches above grade. Provide cathodic protection to meet requirements of governing authorities and servicing utility.

B. Buried Pipe:
   1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
   2. Excavation and Backfill:
      a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
      b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
      c. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of a testing laboratory.
      d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone."
Remove and dispose off site native excavation material at no expense to Owner. Adequate width of trench for proper installation of piping or conduit.

e. Support Foundations:
   1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
   2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.
   3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
   4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.

f. Backfilling:
   1) Following installation and successful completion of required tests, backfill piping in lifts.
      a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
      b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
   2) Backfill Material:
      a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
      b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:
   1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:
      a) Mechanical tamper,
      b) Vibratory compacter, or
      c) Other approved methods appropriate to conditions encountered.
   2) Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.
3.5 JOINT RESTRAINTS

A. Install per manufacturer's instructions and recommendations.

B. Reference 3.01, General Installation Requirements.

3.6 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

A. Piping Routing:
   1. Route piping, except as otherwise indicated, vertically and horizontally (sloped to drain). Avoid diagonal runs wherever possible. Orient horizontal routes parallel with walls and beam lines.
   2. Install piping as shown or described by diagrams, details and notations on Drawings or, if not indicated, install piping to provide the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.
   3. Install piping in concealed spaces above finished ceilings. Prior to design and installation. Obtain pre-approval by Architect for exposed piping.
   4. In open-to-structure areas which are open to public view, route exposed piping to minimize visual impact. Obtain Architect's and Engineer's approval of exposed piping installation.
   5. Coordinate installation with other trades. Route piping as required to avoid building structure, equipment, plumbing piping, HVAC piping, ductwork, lighting fixtures, electrical conduits and bus ducts and similar work. Final location of lighting will have priority over final sprinkler locations. Provide drains to trapped sections of system which result from such routing. Other trades take precedence for installation space.
   6. Support piping adjacent to walls, overhead construction, columns and other structural and permanent enclosure elements of the building. Limit clearance to 2-inches wherever furring is indicated for concealment of piping. Allow for insulation thickness. Locate insulated piping to provide minimum 1-inch clearance outside insulation.
   7. Wherever possible in finished and occupied spaces, conceal piping from view by locating within column or beam enclosures, hollow wall construction, or above suspended ceilings. Do not encase horizontal routes in solid partitions, except where approved.
   8. General Electrical Equipment Clearances: Do not route piping through electrical rooms, transformer vaults, elevator equipment rooms and other electrical or electronic equipment spaces and enclosures. Within equipment rooms, provide minimum 3-feet lateral clearance from sides of electric switchgear panels. Do not route piping above electric power or lighting panel, switchgear, or similar electric device. Coordinate with electrical and coordinate exact pipe routing to provide proper clearance with such Item.
   9. Route water filled and dry system piping around, not into or through, rooms protected by pre-action systems, clean-agent systems, gaseous suppression systems and other alternative fire suppression systems.
   10. Install piping as close as possible to ceiling to avoid conflicts with other trades.
   11. Install pipe runs to minimize obstruction to other work.
   12. Pitch pipe for dry system piping passing through warm as well as cold areas.

B. Couplings:
1. Install where indicated on Drawings and on each side of pieces of equipment to permit easy removal of equipment.
2. Deburr cut edges.

C. Pipe Penetrations: Wire pipe cutout coupon at point of pipe penetration.

D. Pipe and Pipe Fittings:
1. Expansion and Flexibility: Install work with due regard for expansion and contraction to prevent damage to the piping, equipment, building and its contents. Provide piping offsets, loops, approved type expansion joints, sway bracing, wire restraints, vertical restraints, flexible couplings or other means to control pipe movement and to minimize pipe forces.
2. Coordinate support of pipe 4-inches and larger with Structural Engineer.
3. Provide clearances around piping per NFPA 13.
4. Pitch pipe for dry system piping located or passing through warm as well as cold areas.
5. Install welded pipe with welds facing vertically up, or where this is not possible, as close as possible to vertical between 46 degrees and 234 degrees. Intent is to minimize corrosion caused by moisture in the bottom of pipes.

3.7 WALL AND FLOOR PENETRATIONS AND SLEEVES

A. Escutcheons: Install on exposed pipes passing through walls or floors.
1. Pipe Sleeves: Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrinking fire and water resistant grout or equal caulking compound. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements.
3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Caulk/seal piping passing through fire-rated building assemblies with UL Listed or FM Approved fire-rated firestopping compound. Provide fire-rated assemblies per local AHJ requirements.
4. Beam Sleeves: Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
5. Penetrations in Fire-Rated Wall/Floor Assemblies:
   a. Reference Division 07, Thermal and Moisture Protection.
   b. Coordinate with Drawings location of fire rated walls, ceilings and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material.
c. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814 and NFPA.

d. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814.

3.8 SWITCHES, WATER DETECTOR

A. Wire pipe cutout coupon at point of connection of switch to pipe.

B. Flow switches: Connect to system side of valves and drain connections.

C. Coordinate with Division 28, Electronic Safety.

3.9 HANGERS AND SUPPORTS

A. Installation of pipe hangers, inserts and supports to conform to NFPA 13. Provide adjustable hangers, inserts, brackets, clamps, supplementary steel and other accessory materials required for proper support of pipe lines and equipment. Provide supplementary materials for proper support and attachment of hangers.

3.10 STRUTS AND STRUT CLAMPS

A. Install per manufacturer's listed orientation.

3.11 SWAY BRACES AND RESTRAINTS

A. Locate per orientation and spacing as required by sway brace calculations.

B. Attach sway bracing directly to pipe or equipment being braced.

C. Do not attach sway bracing to bottom of truss members.

3.12 ANCHORS AND ATTACHMENTS

A. In post-tension construction, determine location of post-tension cables and install anchors to avoid contact or interference with post-tension cables. Coordinate with Structural.

B. Do not use powder-driven attachments.

C. Building Attachments and Inserts: Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves and flanges, for sizes NPS 2-1/2 and larger. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

D. Hanger and Support Attachments:
   1. Concrete:
      a. Before Pouring: Support piping and equipment from malleable iron concrete form inserts placed before concrete is poured.
      b. After Pouring:
1) Where supports in slabs are required after concrete has been poured, provide drilled-in threaded inserts (mechanical-expansion anchors), installed in accordance with manufacturer's recommendations.

2) Install mechanical-expansion anchors after concrete is completely cured and in accordance with manufacturer's installation instructions.

3) Where anchors are to be installed in post-tension construction, determine and avoid locations of post-tension cables prior to drilling.

2. Metal Floor Deck: Support hangers per UL Listing or FM Approval for selected concrete insert before pouring of concrete topping, or from beam clamps fastened to structural steel.

3. Steel Joists: Support hangers from beam clamps fastened to bar joists or to auxiliary steel between bar joists as required.

4. C-Clamp Hangers: Do not attach to one side of double-angle bottom members.

5. Locate and install hangers, supports and attachments connecting to I-joists, structural insulated panels (SIPs), cross laminated timber and similar engineered structural products according to the structural product manufacturer specifications.

E. Make available to the Architect information required to verify the anchorage, sway bracing and restraint of fire protection systems.

3.13 GAUGES

A. Install gauges conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Install with dial positioned for maximum visibility.

3.14 BELLS

A. Locate exterior alarm bells at 8-feet above finished grade. Coordinate with Architect.

B. Coordinate with Divisions 26, Electrical and Division 28, Electronic Safety.

3.15 FIRE DEPARTMENT CONNECTION

A. Locate with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

B. Provide method of draining FDC piping. Drain to sanitary sewer by indirect connection, or to exterior where damage, including damage to landscaping and staining of concrete, will not occur.

C. Locate away from building egress paths. Coordinate location with Fire Marshal.

3.16 VALVES

A. General:
   1. Provide post indicator on buried control valves.
   2. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
B. Installation:
   1. Install valves where required for proper operation, testing and drainage. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install conveniently and accessibly located with reference to finished building for repairs, removal and service.
   2. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.
   3. Wafer Check Valves: Install between two flanges in horizontal or vertical position, position for proper direction of flow.

C. Pressure Relief Valves: Provide piping to permanent drain.

D. Pressure Reducing/Regulating Valves:
   1. Provide separate, supervised, control valve on each side of pressure regulating valve.
   2. Provide pressure gauge on each side of pressure reducing and pressure regulating valves.

E. Valve Sequencing:
   1. Provide fire-alarm-supervised sectional control/isolation valves so that areas of the sprinkler system can be left in operation while providing isolation in the demolition areas.
   2. Sequence demolition with installation of new supplies to future phasing. Provide temporary supplies where piping serving a later phase runs through an area of an earlier phase. Sequence with architectural and structural phasing plans.

3.17 POST INDICATOR VALVE ASSEMBLIES

A. Install plumb and conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Provide post indicator on buried control valves. Orient so “Open” and “Shut” signs are visible from street, or as required by AHJ.

C. Provide supervisory switch connected to fire alarm system.

3.18 BACKFLOW PREVENTION DEVICES

A. Install conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Provide listed backflow assembly at sprinkler system water source connection. Coordinate with local utility; conform to their installation requirements.

C. Provide method of forward flow testing at full system demand without dismantling any part of the system. Indicate location, method of testing and location of test drain discharge on submittal and As-Built Drawings. Provide signage as required by NFPA 13. Locate drainage for forward testing where damage will not occur, including damage to landscaping.

D. Chain and padlock in "open" position. Provide two sets of keys.
E. Provide control valve supervisory switches connected to the fire alarm system.

F. Reduced Pressure Backflow Preventer:
   1. Locate within 5-feet of finished floor near drain shown on Plumbing Drawings or an existing drain of sufficient size which can accept full discharge of relief valve without doing damage or arrange and pay for installation of a suitable size drain.
   2. Provide drain piping to sanitary sewer. Coordinate with Division 22, Plumbing.

3.19 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker, secured with corrosion-resistant chain or permanent adhesive on or near each Item of fire suppression equipment and each operational device, as specified in this specification if not otherwise specified for each Item or device. Provide signs for the following general categories of equipment and operational devices: Valves, drains, pumps, standpipes, tanks and similar equipment. Provide valve tag on every valve and control device in each piping system. Exclude check valves and valves within factory fabricated equipment units. List each tagged valve in valve schedule for each piping system.

B. Each new piece of equipment to bear a permanently attached identification plate, listing manufacturer's name, capacities, sizes and characteristics.

C. Piping to bear the manufacturer's name, schedule of thickness, size and ASTM identification number

D. Provide valve tag on every valve and control device in each piping system. Exclude check valves and valves within factory fabricated equipment units. List each tagged valve in valve schedule for each piping system.

E. Drain, Auxiliary Drain and Drum Drips: Provide valve tag on every valve in each fire suppression system. List each tagged valve and its location in valve schedule, identify on fire suppression drawings.

F. Install framed, glass or rigid transparent plastic covered, mounted valve schedule and valve location drawing in main riser or fire pump room.

G. Provide identification sign on ceiling tile below valve location.

H. Provide permanent identification sign at pressure regulating valves stating required setting of pressure regulator.

I. Adjusting: Relocate fire suppression identification device which has become visually blocked.

J. Cleaning: Clean face of identification devices and glass frames of valve charts.

3.20 SIGNS

A. General Information Signs: Provide a general information sign used to determine system design basis and information relevant to the inspection, testing and maintenance requirements
required by NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. Such general information is to be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire, chain, or other acceptable means. Such signs are to be placed at each system control rise loop and auxiliary system control valve. The sign is to include the following information:

1. Name and Location of the Facility Protected
2. Presence of High-Piled and/or Rack Storage
3. Maximum Height of Storage Planned
4. Flow Test Data
5. Location of Auxiliary Drains and Low Point Drains
6. Original Results of Main Drain Flow Test
7. Name of Installing Contractor or Designer
8. Indication of presence and location of other auxiliary systems.

B. Dry Signs: At system riser supplying dry systems, provide the following information: volume in gallons contained in each system.

3.21 DRAINS

A. Locate drain connections within 7-feet of floor. Provide piping capable of being fully drained.

B. Provide a drain vent at top of vertical drains. Coordinate with Division 22, Plumbing.

C. Coordinate location of auxiliary drains with Architect. Architect to approve location before drain is installed.

D. Protect drains from tampering and accidental operation.

E. Protect drain discharge at the exterior with a turned-down 45 degree elbow.

END OF SECTION
SECTION 21 13 00
FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Sprinklers
   2. Flexible Sprinkler Hose Fitting Assembly - For fire sprinklers in suspended ceilings which are supplied by a wet pipe system.
   3. Floor Control Assembly
   4. Wet System Air Vent
   5. Spare Sprinkler Cabinet

B. This is a contractor designed system. Contact AHJ prior to bid to verify fire system requirements. Provide design compliant with codes as interpreted by AHJ.

C. Scope:
   1. Wet-Pipe Sprinkler System.
   2. Sprinkler protection for areas subject to 40 degrees F and lower: Dry-pipe sprinkler system, dry sprinklers in areas subject to 40 degrees F or less.
   3. Private fire service main, including connection to existing utility and piping to the inlet connection inside the building. Provide required valves, backflow preventer, vaults and appurtenances.
   4. Attic sprinklers.

D. Coordinate location and type of tamper, flow and pressure switches and fire alarm system.

E. Provide electrical connections and wiring as required for a complete and operable system. Includes but is not limited to bells, air compressors, sump pumps, fire pumps, jockey pumps and pump controllers.

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression apply to this Section.

B. In addition, reference the following:
   1. Division 22, Plumbing
   2. Division 23, Heating, Ventilating and Air-Conditioning
   3. Division 26, Electrical
   4. Division 28, Electronic Safety
   5. Section 21 00 00, Fire Suppression Basic Requirements
   6. Section 21 05 00, Common Work Results for Fire Suppression

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Section 01410, Regulatory Requirements.
1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Hydraulic calculations.
   2. Sway brace calculations.
   3. Details of sway bracing.
   4. Details of interval and end of branch line restraints.
   5. Details of flexible sprinkler hose fitting assembly, including number and radius of bends, corresponding to equivalent feet used in hydraulic calculations. Provide details of sign to be installed at each flexible sprinkler hose fitting assembly.
   6. Details of oversized ceiling penetrations and oversized sprinkler escutcheons.
   7. Trapeze hanger details and calculations, including size, length and material. Additionally, provide size, weight and number of pipes to be carried on the trapeze.
   8. On submittal and As-Built drawings, provide text of sprinkler list to be installed in the spare sprinkler cabinet.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 SYSTEM DESCRIPTION

A. Provide coverage for building areas as indicated. Field verify field conditions prior to submittal of bid. Adjust bid to provide protection features in accordance with applicable codes and interpretations by AHJ. Provide design and installation based on more stringent requirements if this specification and AHJ requirements differ from Code.

B. Design Parameters:
   1. Increase remote design area for dry systems per NFPA 13.
   2. Building Area: Classrooms.
      a. Occupancy Classification: Light.
      b. Inside Hose Allowance: 0 GPM.
      c. Outside Hose Allowance: 100 GPM.
      a. Occupancy Classification: Ordinary Group 1.
      b. Inside Hose Allowance: 0 GPM.
      c. Outside Hose Allowance: 100 GPM.

C. Sprinkler system design to include a 10 percent pressure and flow cushion between system demand point and available water supplies.
D. Extend hydraulic calculations from hydraulically most remote design area back to location of pressure hydrant of flow test or effective point of water supply where characteristics of water supply are known.

E. Develop cost-effective designs that may include use of extended coverage sprinklers and design area reductions as allowed by NFPA 13.

1.8 EXTRA STOCK

A. Provide extra sprinklers per code.

B. Provide suitable wrenches for each sprinkler type and metal storage cabinet in riser room.

1.9 CONTROL VALVES

A. Sprinkler system control valves to be post indicator valves located minimum of 40-feet from building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Sprinklers:
   1. Finished Areas:
      a. Tyco
      b. Or equal.
   2. Nonfinished Areas:
      a. Tyco
      b. Or equal.
   3. Attic:
      a. Tyco
      b. Or equal.

B. Flexible Sprinkler Hose Fitting Assembly:
   1. Victaulic; VicFlex.
   2. Or equal.

C. Floor Control Assembly:
   1. Victaulic; FireLock 747 with pressure relief valve.
   2. Viking EasyPac
   3. Reliable; Model FCV.
   4. Or equal.

D. Wet System Air Vent:
   1. Potter Electric Signal Company; Model PAV.
   2. Or equal.

E. Spare Sprinkler Cabinet:
   1. Victaulic
   2. Or equal.
2.2 SPRINKLERS

A. Finished Areas:
   1. Type: Glass-Bulb
   2. Style: Concealed
   3. Response: Quick-Response
   4. Finish:
      a. Chrome (Wood Slat Ceilings)
      b. White
   5. Escutcheon:
      a. Chrome (Wood Slat Ceilings)
      b. White
   6. Coverplate for Concealed Sprinklers:
      a. Flat Plate
      b. Chrome (Wood Slat Ceilings)
      c. White

B. Nonfinished Areas:
   1. Type: Glass-Bulb
   2. Response: Quick-Response
   3. Finish: Brass

C. Other Sprinklers:
   1. Type: Glass-Bulb
   2. Style: Attic
   3. Response: Quick-Response
   4. Finish: Chrome

2.3 FLEXIBLE SPRINKLER HOSE FITTING ASSEMBLY

A. Fully welded non-mechanical fittings, stainless steel, braided, leak-tested with minimum 1-inch true-bore internal corrugated hose diameter. 175 psi.

B. Ceiling Bracket: Galvanized steel, direct attachment type, with integrated snap-on clip ends and removable flexible hose attachment with set screw. FM1637, UL 2443.

C. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

2.4 FLOOR CONTROL ASSEMBLY

A. Water-flow alarm, gauge, integral pressure relief valve connected to drain, sight glass, smooth bore orifice union of same size as smallest orifice sprinkler installed.

2.5 WET SYSTEM AIR VENT

A. Brass, UL 2573 with ball valve supervisory switch.
2.6 SPARE SPRINKLER CABINET

A. NFPA 13 Systems: Sized to accommodate a minimum of two spare sprinklers of each Sprinkler Identification Number (SIN), manufacturer, model, orifice, deflector type, temperature and thermal sensitivity, or a minimum of six sprinklers for facilities having under 300 sprinklers, or a minimum of 12 sprinklers for facilities having 300 to 1000 sprinklers, or a minimum of 24 sprinklers for facilities having over 1000 sprinklers, whichever is more.

B. Welded steel with hinged steel cover.

C. Red enamel or polyester coated finish inside and out.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's requirements and recommendations.

3.2 SPRINKLERS

A. Center sprinklers in center or quarter points of suspended ceiling tile.

B. Align sprinklers with architectural column lines, lighting, diffusers and other ceiling features. In unfinished ceilings, route piping to minimize visual impact. Sprinklers and piping not so aligned are to be removed and replaced at no additional cost to Owner.

C. Install dry sprinklers in a manner which does not trap water.

3.3 FLEXIBLE SPRINKLER HOSE FITTING ASSEMBLY

A. Install flexible sprinkler hose fitting assemblies where pendent sprinkler heads are located in acoustic ceiling tiles.

B. Install with no more bends than are included in equivalent footage used in hydraulic calculations.

C. Maintain manufacturer's recommended bending radius as included in equivalent footage used in hydraulic calculations.

D. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

3.4 FLOOR CONTROL ASSEMBLY

A. Install so valves and gauges are conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Provide connection to drain.

C. Provide connection from pressure relief valve to drain.
D. Install with supervised control valve(s) and check valve.

3.5 WET SYSTEM AIR VENT

A. Locate at a point in the system that will vent the most air.
B. Connect at top of pipe.
C. Locate so as not to interfere with sprinkler spray pattern.
D. Locate where it can be easily accessed for inspection and cleaning.
E. Pipe output of air vent to drain with an indirect connector or to exterior where it will not cause damage.

3.6 SPARE SPRINKLER CABINET

A. Attach to wall at the main sprinkler system riser.
B. Locate so cover is easy to open and readily accessible.
C. Locate in an area with a temperature between 40 and 100 degrees Fahrenheit (4 and 38 degrees Celsius).
D. Locate sprinkler wrenches inside cabinet.
E. Inside the cabinet, provide a list of sprinklers installed in the property, including sprinkler identification number, manufacturer, model, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the cabinet and issue or revision date of the list.

END OF SECTION
SECTION 22 00 00

PLUMBING BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 22 00 00, Plumbing Basic Requirements applies to Division 22, Plumbing work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of plumbing systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:
   1. Provide: To furnish and install, complete and ready for intended use.
   2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
   3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
   4. Or Equal: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Section 01330, Submittal Procedures, and approved by the Engineer prior to submitting bids for substituted items.
   5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 22, Plumbing Contract Documents.

B. Related Work:
   1. Additional conditions apply to this Division including, but not limited to:
      a. Specifications
      b. Drawings
      c. Addenda
      d. Owner/Architect Agreement
      e. Owner/Contractor Agreement
      f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Section 01410, Regulatory Requirements, individual Division 22, Plumbing Sections and those listed in this Section.
B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
   1. State of California:
      a. CBC - California Building Code
      b. CEC - California Electrical Code
      c. CEC T24 - California Energy Code Title 24
      d. CFC - California Fire Code
      e. CMC - California Mechanical Code
      f. CPC - California Plumbing Code
      g. CSFM - California State Fire Marshal
      h. DSA - Division of State Architect Regulations and Requirements

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
   1. ABA - Architectural Barriers Act
   2. ADA - Americans with Disabilities Act
   3. AHRI - Air-Conditioning Heating & Refrigeration Institute
   4. ANSI - American National Standards Institute
   5. ASCE - American Society of Civil Engineers
   6. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
   7. ASHRAE Guideline 0, the Commissioning Process
   8. ASME - American Society of Mechanical Engineers
   9. ASPE - American Society of Plumbing Engineers
  10. ASSE - American Society of Sanitary Engineering
  11. ASTM - ASTM International
  12. AWWA - American Water Works Association
  13. CFR - Code of Federal Regulations
  14. CISPI - Cast Iron Soil Pipe Institute
  15. ETL - Electrical Testing Laboratories
  16. EPA - Environmental Protection Agency
  17. FM - FM Global
  18. IAPMO - International Association of Plumbing and Mechanical Officials
  19. GAMA - Gas Appliance Manufacturers Association
  20. HI - Hydraulic Institute Standards
  21. ISO - International Organization for Standardization
  22. MSS - Manufacturers Standardization Society
  23. NEC - National Electric Code
  24. NEMA - National Electrical Manufacturers Association
  26. NFPA - National Fire Protection Association
  27. NRCA - National Roofing Contractors Association
  28. NSF - National Sanitation Foundation
  29. OSHA - Occupational Safety and Health Administration
  30. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
  31. TEMA - Tubular Exchanger Manufacturers Association
  32. TIMA - Thermal Insulation Manufacturers Association
  33. UL - Underwriters Laboratories Inc.
D. See Division 22, Plumbing individual Sections for additional references.

E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

F. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

H. All potable water system components, devices, material, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified in accordance with current editions of the Safe Drinking Water Act (SDWA), NSF 61 & NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.

1.4 SUBMITTALS

A. See Section 01330, Submittal Procedures as well as specific individual Division 22, Plumbing Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:
   1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
   2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each Specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
   3. Product Data: Provide Manufacturer’s descriptive literature for products specified in Division 22, Plumbing Sections.
   4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
a. Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.
c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
d. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.
e. See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet Section 22 05 48, Vibration and Seismic Controls for Plumbing Piping and Equipment. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Structural documents.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.

9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10. Substitutions and Variation from Basis of Design:
   a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
   b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the...
Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or equal", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings: Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout plans, and control wiring diagrams. Reference individual Division 22, Plumbing Sections for additional requirements for Shop Drawings outside of these requirements.
   a. Provide Shop Drawings indicating sanitary and storm cleanout locations and type to Architect for approval prior to installation.
   b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:
   a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
      1) Resubmit for review until review indicates no exception taken or "make corrections as noted".
      2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

14. Operation and Maintenance Manuals, Owners Instructions:
   a. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
      1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
      2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
      3) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
      4) Include copy of startup and test reports specific to each piece of equipment.
      5) Include copy of final water systems balancing log along with pump operating data.
      6) Include commissioning reports.
      7) Include copy of pressure, flow, leakage and purity test data and water systems test data, as applicable. Include copy of third-party and state and local jurisdiction inspection reports.
8) Include copy of valve charts/schedules.
9) Include Warranty per Section 01740, Warranties/Guaranties, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
10) Include product certificates of warranties and guarantees.
11) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 22 00 00, Plumbing Basic Requirements article titled "Demonstration".

c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:
   a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
   b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
   c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
   d. Provide Invert elevations and dimensioned locations for water services, building waste, and storm drainage piping below grade extending to 5-feet outside building line.
   e. See Division 22, Plumbing individual Sections for additional items to include in record drawings.

### 1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State, Federal and other applicable laws and regulations.

B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturers equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

E. Provide products that are UL listed.

F. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

G. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Section 01740, Warranties/Guaranties, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Section 01740, Warranties/Guaranties. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings) to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Section 01311, Project Management and Coordination, and/or Division 22, Plumbing to combine information furnished by other trades onto master coordination documents.

B. Prepare Drawings as follows:
   1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
   2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
   3. Indicate plumbing system piping including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible items. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork and piping.

5. Incorporate Addenda items and change orders.

6. Distribute drawings to trades and provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

1.8 WORK INCLUDED

A. Furnish and install sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.

B. Electrical: For plumbing trim/devices/equipment, provide, from the line voltage connection by Division 26, the low voltage electrical connections and wiring as required for complete and operable system. Includes, but is not limited to: Low voltage electrical raceway, wiring and accessories, such as step-down transformers as necessary for function of sensors and automatic valve and faucet controls. Supply step-down transformers and size wiring as recommended by manufacturer of plumbing trim/faucets requiring electrical low voltage connection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide like items from one manufacturer, including but not limited to fixtures, pumps, drains and equipment.

2.2 MATERIALS

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities.

B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

D. Hazardous Materials:
1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
2. Comply with Section 01412, Hazardous Materials, for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A., Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Install equipment requiring access (i.e., drain pans, drains, control operators, valves, motors, cleanouts and water heaters) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:
   1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
      a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
      b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
      c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:
   1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
      a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
F. Pipe Installation:
   1. Provide installation of piping systems coordinated to account for expansion and
      contraction of piping materials and building as well as anticipated settlement or
      shrinkage of building. Install work to prevent damage to piping, equipment, and building
      and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other
      means to control pipe movement and minimize forces on piping. Verify anticipated
      settlement and/or shrinkage of building with Project Structural Engineer. Verify
      construction phasing, type of building construction products and rating for coordinating
      installation of piping systems.
   2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:
   1. Provide plenum rated materials that meet the requirements to be installed in plenums.
      Immediately notify Architect/Engineer of discrepancy.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Structural documents, Section 22 05 48, Vibration
   and Seismic Controls for Plumbing Piping and Equipment, and individual Division 22
   Plumbing Sections.

B. General:
   1. Earthquake resistant designs for Plumbing (Division 22) equipment and distribution, i.e.
      motors, plumbing systems, piping, equipment, water heaters, boilers, etc. to conform to
      regulations of jurisdiction having authority.
   2. Restraints which are used to prevent disruption of function of piece of equipment
      because of application of horizontal force to be such that forces are carried to frame of
      structure in such a way that frame will not be deflected when apparatus is attached to a
      mounting base and equipment pad, or to structure in normal way, utilizing attachments
      provided. Secure equipment and distribution systems to withstand a force in direction
      equal to value defined by jurisdiction having authority.
   3. Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing
      and seismic movement assemblies for piping equipment and water heaters. Submit Shop
      Drawings along with equipment submittals.
   4. Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible
      joints for piping and crossing building expansion or seismic joints. Submit Shop
      Drawings along with seismic bracing details.

C. Piping:
      published by SMACNA or local requirements.

D. Provide means to prohibit excessive motion of plumbing equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Section 01400, Quality Control
   Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22,
   Plumbing Sections.
B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
1. Underground piping installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch:
1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Plumbing Precloseout Checklist, complete the checklist confirming completion of systems’ installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer’s acceptance that the plumbing systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Comply with individual Division 22, Plumbing Sections and the following:
1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping, and wiring to point of connection.
3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
   a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Section 01730, Cutting and Patching, and individual Division 22, Plumbing Sections and the following:
1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section.
will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing piping and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Section 00700, General Conditions. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3. Protect bright finished shafts, bearing housings and similar items until in service.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Section 01770, Contract Closeout Procedures, Articles 1.12, 1.13, and 1.14, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Section 01770, Contract Closeout Procedures, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.
3.9 CLEANING

A. Confirm cleaning requirements in Section 01710, Cleaning Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

A. Confirm installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
   1. Do not place equipment in sustained operation prior to initial balancing of plumbing systems.
   2. Provide pump impellers to obtain Basis of Design design capacities.

D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.11 PAINTING

A. Confirm requirements in Division 09, Finishes. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
   1. Ferrous Metal: After completion of plumbing work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt for exterior or black enamel for interior, suitable for hot surfaces.
   2. In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
   3. See individual equipment Specifications for other painting.
   4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
   5. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
   6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.
3.12 ACCEPTANCE

A. Confirm requirements in Section 01770, Contract Closeout Procedures. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
   a. Testing and Balancing Reports
   b. Cleaning
   c. Operation and Maintenance Manuals
   d. Training of Operating Personnel
   e. Record Drawings
   f. Warranty and Guaranty Certificates
   g. Start-up/Test Document and Commissioning Reports

3.13 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Tests:
   1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
   2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that plumbing items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize plumbing equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Pressure Gauges
   2. Thermometers
   3. Meters, Positive Displacement (Liquid)
   4. Water Hammer Arrestors (Shock Absorbers)
   5. Trap Primers

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14 apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pressure Gauges:
   1. Dwyer Instruments, Inc.
   2. Moeller Instrument Co., Inc.
   3. Omega Engineering, Inc.
   4. Trerice
   5. Or equal.

B. Thermometers:
PLUMBING DEVICES

2.2 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, phosphor-bronze bourdon type, dry type.
   1. Case: Cast aluminum, stem-mounted, flange less.
   2. Size: 4-1/2-inch diameter.
   5. Scale: White aluminum with black graduation and markings.
   7. Mid-Scale Accuracy: One percent.
   8. Scale: PSI and KPa.
   9. Basis of Design: Trerice Model 600CB.

2.3 THERMOMETERS

A. Thermometers - Adjustable Angle: Red or blue appearing organic liquid in glass, ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9-inch scale.
   2. Window: Acrylic.
   3. Scale: Aluminum, white background, black graduations and markings.
5. Accuracy: 2 percent, per ASTM E 77.
6. Calibration: 0-160 with 2 Degrees F graduations.

2.4 METERS, POSITIVE DISPLACEMENT (LIQUID)

A. Disc Type Meter: Bronze split casing, magnetic drive, heavy duty gear train, completely sealed, circular meter, totalize cubic feet with sweep hand. Comply with AWWA performance standards.

B. Turbine Type Meter: Bronze housing, inlet and outlet straightening vanes, direct magnetic drive, sealed register with odometer type totalization display in cubic feet, center sweep hand, low flow detector, ceramic magnet, AWWA Standard C701.

C. Compound Type Meter: Positive displacement rotating disc style low flow measuring chamber, turbine measuring chamber and automatic control valve. Permanently sealed registers use magnetic drives, odometer type totalization reading in cubic feet with sweep hand, low flow indicator.

2.5 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

A. Piston-type, copper, brass or stainless steel with O-ring piston, pressure rated, tested and certified in accordance with PDI WH-201.

2.6 TRAP PRIMERS

A. Electronic trap seal automatic primer valve with integral anti siphon protection and timer. Coordinate quantity, locations and voltage characteristics for control points.

B. Trap seal primer valve (low lead) with integral automatic anti-siphon protection. The priming valve to discharge on both pressure drop and pressure spike. PPP CPO 500.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. For plumbing devices requiring access from access panels (i.e. trap primers, water hammer arrestors and the like) submit location/size of all access panels to Architect for approval prior to purchase and installation of access panel. See Section 22 00 00, General Plumbing Requirements for additional requirements.

B. Temperature Gauges:
   1. Install in vertical upright position, tilted so as to be easily read at floor.
   2. Thermometer Wells: Install in piping in vertical upright position. Fill well with oil or graphite, secure cup.

C. Provide instruments with scale ranges selected according to service with largest appropriate scale.

D. Install per manufacturer recommendations.
3.2 PRESSURE GAUGES

A. Install pressure gauge where exposure to heat and vibration are minimal and where the dial can be easily read. It is also important to install the gauge in a location with undisturbed and continuous flow of the pressure medium.

B. Provide a needle valve or gauge cock, installed between the process and the pressure gauges.

C. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.

D. Locations: Install in the following locations, and elsewhere as indicated.
   1. At each pump inlet and outlet.
   2. At inlet and discharge of each pressure reducing valve.
   3. At make-up water service outlets.

E. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

F. Pressure Gauge Range/Graduations:

<table>
<thead>
<tr>
<th>System</th>
<th>Pressure (PSI)</th>
<th>Graduations (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Water</td>
<td>0-100</td>
<td>1</td>
</tr>
<tr>
<td>Hot Water</td>
<td>0-100</td>
<td>1</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>0-160</td>
<td>1</td>
</tr>
</tbody>
</table>

G. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Install per manufacturer recommendations.

3.3 THERMOMETERS

A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

B. Provide instruments with scale ranges selected according to service with largest appropriate scale.

C. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

D. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

E. Thermometer Range/Graduations:
<table>
<thead>
<tr>
<th>System</th>
<th>Temperature (Degrees F)</th>
<th>Graduations (Degrees F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Water</td>
<td>25-125</td>
<td>1</td>
</tr>
<tr>
<td>Hot Water</td>
<td>30-240</td>
<td>2</td>
</tr>
</tbody>
</table>

F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Install per manufacturer recommendations.

3.4 METERS, POSITIVE DISPLACEMENT (LIQUID)

A. Where adequate space is not available, use meters specifically designed for short pipe lengths.

B. Install meters in accordance with manufacturer's instructions, and as shown on Drawings. Provide recommended upstream and downstream straight pipe length for accurate reading.

C. Install per manufacturer recommendations.

3.5 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

A. Locate shock absorbers in supply pipe in accordance with recommendations of Plumbing and Drainage Institute PDI-WH201. Install ahead of solenoid operated valves. Determine size of absorber by fixture unit value of fixture supplied, using PDI symbols to designate sizes. Provide access panel for each shock absorber.

B. Install per manufacturer recommendations.

3.6 TRAP PRIMERS

A. Flush supply line prior to installation.

B. Install valve plumb using caution to not over tighten.

C. Effective operating range 20 to 80 PSIG (138 to 552 kPa).

END OF SECTION
SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Valves, General
   2. Balancing Valves
   3. Ball Valves
   4. Swing Check Valves
   5. Backflow Prevention Assemblies
   6. Pressure Regulating Valve-Domestic Water
   7. Thermostatic Master Mixing Valves (ASSE 1017 Rated)
   8. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated)

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. NSF 61, Annex G and/or NSF/ANSI 372 for potable water services. Valves must be 3rd-party certified.
   2. ISO 9001 Certified.
   3. IAPMO Certified for Low Lead.

C. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

D. Model numbers indicated as Basis-of-Design indicate valve characteristics. All valves are to meet code Low Lead/Lead Free Standards.
1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic
   Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Valves: Obtain each type of valve from a single source and from a
   single manufacturer.

B. Valves, General:
   1. Apollo
   2. Armstrong
   3. ASCO
   4. Cla-Val
   5. Conbraco
   6. Crane
   7. Clow
   8. Griswold
   9. Hammond
  10. Hays
  11. Jenkins
  12. Josam
  13. Kennedy
  14. Milwaukee
  15. Mueller
  16. Nibco
  17. Red-White Valve
  18. Smith
  19. Stockham
  20. Tour Anderson
  21. Wade
  22. Watts
  23. Wilkins
  24. Zurn
  25. Or equal.

C. Balancing Valves:
   1. Caleffi
   2. Griswold
   3. Hays
   4. Armstrong CBV
   5. Tour Anderson
   6. Or equal.

D. Ball Valves:
1. See Valves General above.
2. NSF Valves:
   a. Clow
   b. Kennedy
   c. Nibco
   d. Or equal.

E. Swing Check Valves:
1. See Valves General above.

F. Backflow Prevention Assemblies:
1. Backflow Preventers:
   a. Apollo
   b. Cla-Val
   c. Conbraco
   d. Watts
   e. Or equal.
2. Backflow Prevention Assemblies - Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications - 2-inches and Smaller:
   a. Febco 860-with 650A.
   b. Conbraco 40-210-AGD.
   c. Wilkins 375-XL-SAG.
   d. Watts 919-QT-S valve with 919AGC or 919AGF.
   e. Or equal.
3. Backflow Prevention Assemblies - Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications - 2-1/2-inches and Larger:
   a. Febco 860 with 758A.
   b. Conbraco Apollo 40-700 with 758A.
   c. Watts 909-S-NFA-NRS with AGC.
   d. Wilkins 375-FSC.
   e. Or equal.
4. Backflow Prevention Assemblies - Double Check Valve Assembly (DCVA) for Low Hazard Applications - 2-inches and smaller:
   a. Febco 850-650A
   b. Conbraco Apollo 40-110-T2
   c. Watts 007-QT-FDA-S
   d. Wilkins 350-S-XL
   e. Or equal.
5. Backflow Prevention Assemblies - Double Check Valve Assembly (DCVA) for Low Hazard Applications - 2-1/2-inches and larger:
   a. Conbraco Apollo 45-11-1
   b. Watts 709-DCDA with 77F-01-FDA-12
   c. Or equal.
6. Spill Resistant Pressure Vacuum Breaker:
   a. Febco
   b. Conbraco
   c. Watts
   d. Wilkins
e. Or equal.

7. Atmospheric Vacuum Breakers:
   a. Febco
   b. Conbraco
   c. Watts
   d. Wilkins
   e. Or equal.

G. Pressure Regulating Valve-Domestic Water:
   1. Cash Acme
   2. Cla-Val
   3. Watts
   4. Wilkins
   5. Or equal.

H. Thermostatic Master Mixing Valves (ASSE 1017 Rated):
   1. Holby Tempering Valve
   2. Lawler Series 66
   3. Leonard Type TM
   4. Powers LFMM430 (Lead Free)
   5. Symmons Temp Control Series 5
   6. Or equal.

I. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated):
   1. Lawler
   2. Leonard
   3. Powers Hydroguard
   4. Or equal.

2.2 VALVES - GENERAL

A. General:
   1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
   2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6-inches and smaller. Provide gear operators for quarter-turn valves 8-inches and larger and plug valves installed over 5-feet above finished floor.
   3. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

B. Valves in Insulated Piping: With 2-inch stem extension and following features:
   1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation on valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.

C. Valve-End Connections:
   1. Flanged: With flanges according to ASME B16.1 for iron valves.
   2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With thread according to ASME B1.20.1.

D. Valve Bypass and Drain Connections: MSS SP-45.

E. Building Service:
   1. Shutoff and Isolation Valves:
      a. Pipe Sizes 3-inches and Smaller: Ball Valve.
   2. Drain Service: Ball Valves.
   3. Strainer Blow-Off: Ball Valve.

2.3 BALANCING VALVES

A. Maximum 125 PSIG System Working Water Pressure.

B. Manual Set Balancing Valves:
   1. Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
      a. Precise flow measurement.
      b. Precision flow balancing.
      c. Positive drip-tight shut-off.
   2. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves have a minimum of five full 360 degree handwheel turns. 90 degree circuit-setter style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves to be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi to have two 1/4-inch threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves to be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug to be brass. The handwheel to be high-strength resin.

2.4 BALL VALVES

A. All ball valves on brazed piping are to be three-piece.

B. 2-1/2-inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, brass or stainless steel ball, Teflon seat, brass stem, or extended steel handle. Apollo 77 CLF 100 Series two-piece.

C. 3-inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, brass or stainless steel ball, Teflon seat, brass stem, or extended steel handle. Apollo 82-100/82A 140 Series three-piece.

D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated or stainless steel ball and stem. TFE seats, 600 PSI.
2.5 **SWING CHECK VALVES**

A. 2-inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80.

B. 2-1/2-inches and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Nibco F918. MMS SP-71.

C. Rubber Flapper Check Valve: Horizontal or vertical upward flow installation. Working pressure to 175 PSI. Ductile iron or cast iron body. Steel reinforced Buna-N rubber flapper epoxy coating on wetted parts. MSS SP-80.

D. Check Valve: Horizontal installation. Working pressure to 300 PSI, Type 304/302 Stainless Steel conforming to ASTM 167. Ductile body, ASTM A536, and stainless clapper, EPDM, nitrile or optional viton bumper and bonnet seals. Stainless wetted parts.

2.6 **BACKFLOW PREVENTION ASSEMBLIES**

A. General: Assemblies model numbers listed below are for general comparison. Project specific model numbers to be verified contractor as approved by jurisdiction where project is located.

B. Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications:
   1. 2-inches and Smaller: Assembly consists of shutoff ball valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1013 and AWWA C511. Bronze construction, threaded ends, stainless steel internal parts, FDA strainer, and air gap fitting. Route pipe from air gap fitting to approved waste receptor.
   2. 2-1/2-inches and Larger: Assembly consists of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C511. Epoxy coat cast iron body construction, flanged ends, stainless steel internal parts, bronze seats, and FDA strainer.

C. Double Check Valve Assembly (DCVA) for Low Hazard Applications:
   1. 2-inches and Smaller: Assembly consists of shutoff ball valves in inlet and outlet, and FDS strainer on inlet. Assemblies include test cocks and two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C510. Bronze construction, threaded ends, and stainless steel internal parts.
   2. 2-1/2-inches and Larger: Assembly consists of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C510. Epoxy coat cast iron body construction, strainer flanged ends, and stainless steel internal parts.

D. Spill Resistant Pressure Vacuum Breaker: Watts Model 800MCQT with 777S "Y" strainer.
E. Atmospheric Vacuum Breaker: Assembly consists of a bronze vacuum breaker body with silicone disc, and full size orifice. Device to be IAPMO listed, meet ASSE standard 1001, and ANSI standard A113.1.1 rough chrome plate finish.

2.7 PRESSURE REGULATING VALVE-DOMESTIC WATER

A. Water: Bronze body, diaphragm or piston type, spring actuated, with separate or integral stainless steel strainer, pressure to suit conditions, approved for potable water use, low lead. Provide shutoff valves, pressure relief valves, unions, drain valve and bypass.

B. Water: Automatic control pressure regulating valve, stainless steel seat, stem and spring, diaphragm actuated with brass body, hydraulic control pilots with effluent operating temperature range 32 degrees F to 180 degrees F, FDA and AWWA approved.

C. Water: Bronze body construction, stainless steel strainer screen, thermal expansion bypass with renewable stainless steel seat and high temperature resisting diaphragm.

2.8 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 RATED)

A. Thermostatic type with bronze body construction, corrosion resistant materials, union end stops, check inlets with strainers, 0-200 degree F dial thermometer and discharge shut-off valve. Mixing valves to meet ASSE 1017.

B. Maximum required delta temperature differential between hot water supply temperature and delivery temperature is 15 degrees F. Set valve outlet temperature per drawing requirements.

C. Flow from the tempered water circulating pump to be split to mixing valve and building hot water heating system.

2.9 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED)

A. Thermostatic type with bronze body construction, corrosion resistant materials, union end stops, check inlets with strainers, 0-200 degree F dial thermometer and discharge shut-off valve. Mixing valves to meet ASSE 1070.

B. Maximum required delta temperature differential between hot water supply temperature and delivery temperature is 15 degrees F. Set valve outlet temperature per drawing requirements.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and weld ends.
   4. Block check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.

D. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.

E. Purge and clean all piping to be connected to valve.

F. Install per manufacturer's recommendations.

G. Determine that the valve and its plumbing piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that all mating flanges are in line and parallel to minimize straining on joints and valve body.

H. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

I. Do not attempt to repair defective valves; replace with new valves.

J. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

K. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.

L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.

N. Stem Selection: Outside screw and yoke stems, except provide inside screw, non-rising stem where space prevents full opening of OS&Y valves.

O. Seats: Renewable seats, except where otherwise indicated.

P. When soldering, use paste flux that are approved by the manufacturer for use with lead free alloys.

Q. If valve applications are not indicated on Drawings, use the following:
1. Shutoff Service: Ball valves.

R. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

S. Valves, except wafer/butterfly types, with the following end connections:
   1. For Copper Tubing, 2-inches and Smaller. Threaded ends except where solder-joint valve-end.
   2. For Copper Tubing, 2-1/2-inches to NPS 4-inches. Flanged ends except where threaded valve-end.
   3. For Copper Tubing: 5-inches and Larger: Flanged ends.
   4. For Steel Piping, 2-inches and Smaller: Threaded ends.
   5. For Steel Piping, 2-1/2-inches to NPS 4-inches: Flanged ends except where threaded valve-end.
   6. For Steel Piping, 5-inches and Larger: Flanged ends.

T. Valve Adjusting and Cleaning:
   1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
   2. Valve Identification. Tag valves per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.2 BALANCING VALVES

A. See General Installation Requirements above.

B. Install with flow in the direction of the arrow on the valve body and installed at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Mounting of valve in piping must prevent sediment build-up in metering ports.

3.3 BALL VALVES

A. See General Installation Requirements above.

3.4 SWING CHECK VALVES

A. See General Installation Requirements above.

B. Swing Check Valve Installation: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow. Only install where there are 10 pipe diameters of straight pipe upstream of valve.

C. Ejector and Sump Pump-Discharge Check Valves:
   1. 2-inches and Smaller: Bronze swing.
   2. 2-1/2-inches and Larger: Rubber flapper swing check valves with lever and weight.

D. Domestic Water and Circulation Pump Discharge Check Valves:
1. 2-inches and Smaller: Bronze body, spring loaded, lead free, lift check. 
2. 2-1/2-inches and Larger: Wafer style, silent lift check valve, lead free. 

3.5 BACKFLOW PREVENTION ASSEMBLIES 

A. See General Installation Requirements above. 
B. Install where indicated, and where required by code. Where practical, locate in same room as equipment being protected. 
C. Submit product cut sheets to local AHJ for approval prior to purchase and installation. 
D. Install as close to wall as possible with clearances for access and maintenance as required by AHJ. 
E. Coordinate exact location of installation and type of backflow device serving a particular piece of equipment with AHJ and Architect prior to purchase and installation. 
F. Provide wall/floor brackets that are of fully welded, hot dipped galvanized construction, fabricated to meet field conditions. Mount backflow preventer to brackets using cadmium plated "U" type bolts and nuts. 
G. Contact local water district/backflow specialist and request backflow installation requirements. Install backflow devices per UPC and local water district/backflow specialist requirements. 
H. Route waste piping from air gap waste fitting concealed within walls to point of air gap termination at indirect waste receptor. 
I. Follow local codes for installation requirements. Pipe lines should be thoroughly flushed to remove foreign material before installing the unit. Provide a strainer ahead of backflow preventer to prevent disc from unnecessary fouling. Install valve inline with arrow on valve body pointing in the direction of flow. It is important that the valve be easily accessible to facilitate testing and servicing. Do not install in a concealed location. 

3.6 PRESSURE REGULATING VALVE-DOMESTIC WATER 

A. See General Installation Requirements above. 
B. Install valve in the line with arrow on valve body pointing in the direction of flow. This valve should be installed where it is accessible with sufficient clearance for cleaning, service or adjustment. Install the reducing valve before a sill cockline if possible. Before installing the reducing valve hose bibb, flush out the line to remove loose dirt and scale which might damage valve disc and seat. 
C. Horizontal installation is recommended. However, valve can be installed in a vertical position. Regulator must be installed in an accessible location to facilitate servicing the regulator. 
D. To readjust reduced pressures, loosen adjusting screw nut and turn adjusting screw clockwise to raise reduced pressure and counterclockwise to lower reduced pressure.
E. When reducing valve is used, it makes a closed system; therefore, pressure relief protection must be provided on the downstream side of the reducing valve to protect equipment.

F. Provide pressure relief valve and terminate discharge to indirect waste receiver.

G. Anytime a reducing valve is adjusted, the use of a pressure gauge is recommended to verify correct pressure setting. Do not bottom out adjusting screw or spring cage.

H. Provide inlet and outlet ball valves. Provide pressure gauge on valve outlet.

I. Provide pressure relief valve piped full size to indirect waste receiver or floor drain.

J. Provide factory startup on automatic control valves.

3.7 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 RATED)
   A. See General Installation Requirements above.
   B. Install mixing valve per manufacturer's instruction manual.

3.8 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED)
   A. See General Installation Requirements above.
   B. Install mixing valve per manufacturer's instruction manual.

END OF SECTION
SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Pipe Hangers and Supports for Plumbing Piping and Equipment
   2. Wall and Floor Sleeves
   3. Building Attachments
   4. Flashing
   5. Miscellaneous Metal and Materials

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   2. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.
   3. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
   4. Install piping per SMACNA's requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   2. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
      a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is
experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

3. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems whose products have been in satisfactory use in similar service for not less than 10 years.

4. Support systems to be supplied by a single manufacturer.

1.6  WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Section 01740, Warranties/Guaranties.

1.7  PERFORMANCE REQUIREMENTS

A. General - Provide pipe and equipment hangers and supports in accordance with the following:

1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for piping are not shown on the Drawings, the contractor is responsible for their design.

2. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems:

1. Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.

2. Equipment and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.

D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.

E. Provide seismic restraint hangers and supports for piping and equipment. See Section 22 05 48.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment. See Section 22 05 48.

PART 2 - PRODUCTS

2.1  MANUFACTURERS

A. Pipe Hangers and Supports for Plumbing Piping and Equipment:

1. Pipe Hangers/Supports:

   a. B-Line Systems, Inc.
   b. Anvil International
   c. HOLDRITE
   d. Erico Co., Inc.
   e. Rilco Manufacturing Co. Inc.
   f. Nelson-Olson Inc.
2. Channel Support Systems:
   a. B-Line Systems, Inc.
   b. Anvil International, Anvit-Strut
   c. Erico Hanger Co., Inc.; O-Strut Div.
   d. Unistrut Corp.
   e. HOLDRITE EZ-Strut Systems
   f. Or equal.

3. Thermal-Hanger Shield Inserts:
   a. Erico Hanger Co., Inc.
   b. Pipe Shields, Inc.
   c. Rilco Manufacturing Co., Inc.
   d. HOLDRITE Insulation Couplings
   e. Or equal.

4. Freestanding Roof Supports:
   a. Erico Hanger Co., Inc.
   b. Nelson-Olsen Inc.
   c. B-Line
   d. M. Fab
   e. Or equal.

5. Pipe Alignment and Secondary Supports:
   a. HOLDRITE
   b. Starquick
   c. Or equal.

B. Wall and Floor Sleeves:
   1. Below Grade and High Water Table Areas:
      a. Modular Link Sealing System at Pipe Sleeves:
         1) Thunderline Corporation
         2) Or equal.
   2. Pre-Engineered Firestop Pipe Penetration Systems:
      a. HOLDRITE HydroFlame
      b. Proset
      c. Or equal.

C. Building Attachments:
   1. Anchor-It
   2. Gunnebo Fastening Corp.
   3. ITW Ramset/Red Head
   5. Or equal.

D. Flashing:
   1. Fastenal
   2. Or equal.

E. Miscellaneous Metal and Materials:
   1. See Miscellaneous Metal and Materials article below.
2.2 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

A. Horizontal Piping Hangers and Supports - Horizontal and Vertical Piping, and Hanger Rod Attachments:
   1. Factory fabricated horizontal piping hangers and supports to suit piping systems in accordance with manufacturer's published product information.
   2. Use only one type by one manufacturer for each piping service.
   3. Select size of hangers and supports to exactly fit pipe size for bare piping and to exactly fit around piping insulation with saddle or shield for insulated piping.
   4. Provide copper-plated hangers and supports for uninsulated copper piping systems.
   5. Provide padded pipe hangers, clamps and supports for thermoplastic piping systems.
   6. Install no hub cast iron pipe and fittings per CISPI 301-09 Installation Procedures for Hubless Cast Iron Pipe and Fittings for Sanitary and Storm Drain Waste and Vent Piping Applications. Brace hubless cast iron pipe and fittings 5-inch and larger with HOLDRITE No Hub Pipe Restraints or equal.

B. Pipe Hangers, Guides and Channel Systems:
   1. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
   2. Hanger Rod Couplings: Malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
   3. Pipe Rings for Hanger Rods: Pipe sizes 2-inch and smaller, MSS SP Type 6 or Type 10, or equal. Pipe sizes 2-1/2-inches and larger, clevis type hangers with adjustable nuts on rod. MSS SP Type 1. Pipe rings to have same finish as hanger rods.
   4. Channel Type Pipe Hanging System: Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A570 GR33; one side of channel to have a continuous slot with in-turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.

C. Pipe Saddles and Shields:
   1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
   2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).

D. Thermal-Hanger Shield Inserts: 100-PSI (690-kPa) minimum compressive strength insulation, encased in sheet metal shield.
   1. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier.
   2. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate.
   3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
   4. For Clevis or Band Hanger: Insert and shield to cover lower 180 degrees of pipe.
5. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.

6. Thermal Hanger Shield Inserts should be provided at the hanger points and guide locations on pipes requiring insulation. The Inserts should consist of Polyisocyanurate (urethane or phenolic insulation) encircling the entire circumference of the pipe with a 360 degree PVC (1.524 mm thick) with a living hinge and J lock and installed during the installation of the piping system.

E. Concrete Inserts:
   1. Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.

F. Continuous Concrete Insert:

G. Beam Clamps:
   1. MSS Type 19 and 23, wide throat, with retaining clip.
   2. Universal Side Beam Clamp: MSS Type 20.

H. Below Ground:
   1. Pipe Hangers: Adjustable Clevis type, Federal Specification WW-H-171 (Type 1), UL listed, stainless steel Type 316. MSS Type 1. If PVC piping to be used, provide Type 1 hanger, coated for PVC piping.
   2. Rod: 5/8-inch stainless steel Type 316.
   3. Eyebolt: Stainless steel Type 316.
   4. Nuts and Washers: Stainless steel Type 316.

I. Hangers for Pipe Size 2-inches and Smaller:
   1. Adjustable swivel ring hanger, UL listed, Type 6 or Type 10.

J. Hangers for Pipe Size 2-1/2-inches and Larger:
   1. Adjustable clevis type, UL listed, Type 1.

K. Riser Clamps:
   1. Steel, UL listed. MSS Type 8.

L. Plumbers Tape:
   1. Not permitted as pipe hangers or pipe straps.

M. Pipe Alignment and Secondary Support Systems:
   1. Secondary Pipe supports for general applications (Non-Acoustical).
      a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
      b. Supports may be used when sound and/or vibration transfer is not a concern.
   2. Secondary pipe supports for sound and vibration attenuation (Acoustical).
      a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
b. Acoustical pipe supports will be manufactured and installed in compliance with International Organization for Standardization (ISO) 3822-1 with current amendments.

c. Supports will be used when sound and/or vibration transfer is a concern. Locations where acoustical supports will be provided and include but are not limited to partition walls between living units, tenant spaces, retail units, mechanical rooms and lobbies.

d. Support Products:
   1) Support to Wall Brace and Wall Stud Penetrations: HOLDRITE #261, #262, #263, and #264, or equal.
   2) Pipe Wrap for Pipe Clamps and Channel-Mounted Pipe Clamps: HOLDRITE #270, or equal.
   3) Pipe Wrap for Pipe Hangers: HOLDRITE #271, #272-2, and #272-4, or equal.
   4) Drop-Ear Fitting Support: HOLDRITE #265, or equal.
   5) Floor Riser Isolation Pads: HOLDRITE #275-T, or equal.
   6) Floor Isolation Pads (General Applications): HOLDRITE #274, #275, #276, and #278, or equal.

N. Freestanding Roof Pipe Supports:
   1. Polyethylene high-density U.V. resistant quick "pipe" block with foam pad.
   2. Recommended installation is for pipe blocks to be freestanding.
   3. Piping 3-inches and larger mounted on block type supports.

2.3 WALL AND FLOOR SLEEVES

A. Below Grade and High Water Table Areas:
   1. Modular Link Sealing System at Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal. Use a modular link sealing system at sleeves to continuously fill the annular space between the pipe and the wall opening. Provide Link-seal Type C unless otherwise noted. OS with S-316 stainless construction for continuous water/tank walls.
   2. Sleeves through concrete foundation walls and floors. Ductile iron pipe. Class 50 or 51 pipe conforming to ANSI/AWWA C151/A21.51, cement lined. Pipe sleeve will extend a minimum of 6-inches beyond outside perimeter of foundation. Final placement of sleeve will be confirmed with project's structural engineer. In areas with a high water table, provide AWWA C900, Class 235 plastic pipe in lieu of ductile iron pipe.

B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

C. Insulating Caulking: Eagle or Pitcher Super 66 high temperature cement.

D. Fabricated Accessories:
   1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
   2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide following minimum gauges for sizes indicated:
      a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
b. Sleeve Sizes 5-inches to 6-inches: 16 gauge.
c. Sleeve Sizes 7-inches and Larger: 14 gauge.
d. Fire-Rated Safing Material:
   1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 lbs./cu.ft. density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
   2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.4 BUILDING ATTACHMENTS

A. General: Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project Structural Engineer. Provide anchor bolts suitable for cracked concrete.

B. Anchor Bolts:
   1. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
   2. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.

C. Beam Clamps:
   1. MSS Type 19 and 23, wide throat, with retaining clip.
   2. Universal Side Beam Clamp: MSS Type 20.

D. Powder-Actuated Drive Pin Fasteners:
   1. Powder-Actuated Drive-Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

E. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

F. Grout: ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
   1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
   3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

2.5 FLASHING

A. Steel Flashing: 26 gauge galvanized steel.
B. Safes: 8 mil thick neoprene.

C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

D. Provide hot dipped galvanized components for items exposed to weather.

2.6 MISCELLANEOUS METAL AND MATERIALS

A. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings, that are necessary for completion of the project. The Contractor is responsible for their design.

1. Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or equal.

C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods and equipment required for fabrication.

G. Provide hot dipped galvanized components for items exposed to weather.

H. Use straps, threshold rods and wire with sizes required by SMACNA to support piping.

I. Grout: ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.

2. Properties: Nonstaining, noncorrosive, and non gaseous.

3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.
PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Examination:
1. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.

B. Preparation:
1. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate with project structural engineer proper placement of inserts, anchors and other building structural attachments.

3.2 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

A. Hangers and Supports:
1. Comply with MSS SP-58. Pipe Hanger and Support Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
2. Pipe Ring Diameters:
   a. Uninsulated and Insulated Pipe, except where oversized pipe rings are specified: Ring inner diameter to suit pipe outer diameter.
   b. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.
3. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.
5. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
6. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
   a. Field assemble and install according to manufacturer's written instructions.
7. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
   a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   b. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1
8. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers.
9. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
10. Do not support piping from other piping.
11. Fire protection piping will be supported independently of other piping.
12. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
13. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
14. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchor, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
15. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
16. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.
17. Insulated Piping: (comply with the following)
   a. Attach clamps and spacers to piping.
      1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      3) Do not exceed pipe stress limits according to ASME B31.9.
   b. Install MSS SP-58, Type 39 protection saddles, if insulation without a vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
   c. Install MSS SP-58, Type 40 protective shields on cold piping having a vapor barrier. Shields to span arc of 180 degrees.
      1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
   d. Shield Dimensions for Pipe, not less than the following:
      1) NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
      2) NPS 4 (DN100): 12-inches long and 0.06-inch thick.
      3) NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
      4) NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
      5) NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
   e. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
   f. Insert Material: Length at least as long as protective shield.
   g. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
18. Equipment Clearances: Do not route equipment or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear.
panels. Do not route piping or equipment above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact equipment or pipe routing to provide proper clearance with such items.

19. Pipe supports and hanger spacing (pipe supported from structure or floor-supported) to meet the requirements of References and Standards Article in Part 1 above.

B. Pipe Curb Assemblies:
   1. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
   2. Pipe Curb Assemblies: Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.
   3. Piping above roof to be supported with freestanding roof pipe supports unless detailed otherwise. At roofing applications, the adhesion mastic is to be specifically submitted to and approved by the roofing system manufacturer/installer to maintain the integrity of all warranties.
   4. At concrete floors, install a polyurethane mastic to the support block and adhere in place.

C. Vertical Piping:
   1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
   2. Riser clamps to be directly under fitting or welded to pipe. Provide neoprene pads for all systems except natural gas.
   3. Riser to be supported at each floor penetration.
   4. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

D. Adjusting and Painting:
   1. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping and equipment to proper level and elevations.
   2. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

3.3 WALL AND FLOOR SLEEVES

A. "Link-Seal" Pipe Sleeves: Install at slab on grade floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations (except for DWV piping at slab on grade). Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.

B. Fabricated Pipe Sleeves:
   1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirement, and by waterproofing requirements.
   2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.

4. Seal each end airtight with a resilient nonhardening sealer, UL listed and fire rated per ASTM 814.

3.4 BUILDING ATTACHMENTS

A. Install within concrete slabs or attach to structural steel or wood. Attachment to Wood Structure: Provide MSS Type 34 for attachment to wooden beam or approved attachment for a wood structure.

B. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints and at changes in direction of piping.

C. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.

D. Anchor Bolts:
   1. General: Install anchor bolts for mechanical equipment and piping as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment and piping are hung.
   2. Anchor bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

E. Pipe Anchors:
   1. General: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

F. Bolting:
   1. General: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.

G. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor wall, and through equipment room walls and floors.

H. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
   1. Install fabricated pipe sleeve.
   2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
   3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814 sealant.
I. Piping penetrations through Fire-rated (1 to 3 hour) Assemblies:
   1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
   2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814. Use HOLDRITE HydroFlame or equal.

J. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

K. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.5 FLASHING

A. Flash and counterflash where piping passes through weather or waterproofed walls, floors and roofs.

B. Flash vent soil pipes with flashings per Division 01, General Requirements.

C. Flash floor drains over finished areas and roof drains, 10-inches clear on sides, minimum 36-inches x 36-inches sheet size. See Division 01, General Requirements. Fasten flashing to drain with clamping device.

D. Install built up fixtures (mop sinks, shower stalls, shower floors) with water sealing systems/membranes to meet Code and as prescribed by Division 01, General Requirements and Section 22 00 00, Plumbing Basic Requirements. Meet all Code testing requirements. Provide drainage devices with appropriate flanges, clamps, etc. to meet these installation requirements and ensure a water-tight installation.

3.6 MISCELLANEOUS METAL AND MATERIALS

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.

C. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.
D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

   1. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

F. Fabrication:
   1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates and similar devices. Hot dip galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
   2. Finishes:
      a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas with primer of same material before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
      b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials:
         1) Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
      c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

G. Metal Fabrication:
   1. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
   2. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
3. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of weld and methods used in correcting welding work, and with the following:
   a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   b. Obtain fusion without undercut or overlap.
   c. Remove welding flux immediately.
   d. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

4. Provide hot dipped galvanized components for items exposed to weather.

   END OF SECTION
SECTION 22 05 33
HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Heat Trace Cable (Flow Maintenance)

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.
   1. Section 22 07 00 - Plumbing Insulation
   2. Section 26 00 00 - Electrical Basic Requirements

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. UL 718K Pipe Heating Cable.
   2. CSA Design 3A, 3B, 3C.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Project Record Documents: Record physical locations of thermostats.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Provide minimum heat tracing capacities per linear foot as scheduled on Drawings.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Heat Trace Cable (Flow Maintenance):
1. XL-Trace by Raychem
2. Nelson/CLT
3. Or approved equivalent.

2.2 HEAT TRACE CABLE (FLOW MAINTENANCE)

A. General:
   1. Furnish and install UL Listed, CSA Certified, or FM approved system of heating cables, components and controls to maintain flow for high viscosity fluids.

B. Materials:
   1. Self-regulating Heating Cable: Two nickel-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature along its entire length, allowing the heating cable to be cut to length in the field. Covered with radiation-crosslinked, modified polyolefin dielectric jacket. Internal braid of tinned copper ground shield with an outer jacket of fluoropolymer (-CT), as required per Section 427-23 of the NEC-1996. For installation on plastic piping, apply using aluminum tape (AT-180).
   2. Function: Operate on line voltage without the use of transformers.
   3. Apply power connection, end seal, splice, and tee kit components in the field.

C. Components:
   1. Provide UL listed heating-cable components, CSA certified, or FM Approved for use as part of the system to provide flow maintenance. Component enclosures rated NEMA 4X to prevent water ingress and corrosion. Installation does not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks are not acceptable. Components that make an electrical connection to be reenterable for servicing. No component to use silicone to seal the electrical connections. An exception will be made in areas where a conduit transition is required.

D. System Control:
   1. Thermostatic Control-Line Sensing
      a. Control by a line sensing thermostat variable set point set at 110 degrees F either directly or through an appropriate contactor.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. General: Installation to be by Division 26, Electrical.

3.2 HEAT TRACE CABLE (FLOW MAINTENANCE)

A. Location: See Drawings. Install heat trace within 2-feet of connecting plumbing fixtures.

B. Insulate domestic hot water piping after installation of heating cable. Test the heater circuits prior to insulation installation.

C. Pressure test domestic hot water piping before installing heating cable.
D. Provide as-built diagrams of the tracing installation. Include locations of power connections, end seals, access test points, splices, tee splices, identification of heater circuits and risers, and identification of circuit breakers.

E. Install with power connections, access test points, and end seals accessible. Clearly and permanently label with the circuit number.

F. Affix an “Electric Traced” label to the outside of the pipes thermal insulation on alternating sides at intervals of 5 to 15-feet immediately after the piping has been insulated.

G. Lay cable parallel on pipe or spiral wrap to maintain adequate temperature as required by pipe size and thermal properties of the pipe insulation to be applied.

H. Attach heat trace cable to pipe with polyester tape at increments not exceeding 1-foot.

I. Coordinate installation with work under Division 26, Electrical for electrical service to each thermostat.

J. For underground applications, install with waterproof insulation.

END OF SECTION
SECTION 22 05 48
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Vibration Isolation
   2. Seismic Bracing/Restraint Devices/Systems for Equipment and Piping

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.
   1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
   2. Section 22 30 00 - Plumbing Equipment

1.3 REFERENCES AND STANDARDS

A. References and standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Vibration Isolation:
      a. Product Data: Provide catalog data indicating size, type, load and deflection of each isolator; and percent of vibration transmitted based on lowest disturbing frequency of equipment.
      b. Shop Drawings: Showing complete details of construction for steel and concrete bases including:
         1) Equipment mounting holes.
         2) Dimensions.
         3) Isolation selected for each support point.
         4) Details of mounting brackets for isolator.
         5) Weight distribution for each isolator.
         6) Details of seismic snubbers.
         7) Code number assigned to each isolator.
   2. Seismic Restraint:
      a. Shop Drawings: Show compliance with requirements of Quality Assurance article of this Section. Shop Drawings will be stamped by professional structural engineer licensed in state of California.
      b. Calculations: Submit seismic calculations indicating restraint loadings resulting from design seismic forces. Include anchorage details. Calculations will be certified by professional structural engineer licensed in the state of California.
c. Certifications: For restraining devices submit pre-approval certification number from government agency. Where pre-approval is not available, submit testing performed by independent laboratory or calculations sealed by professional structural engineer licensed in state of California certifying isolators and restraints will withstand seismic forces encountered.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Vibration Isolation:
      a. Except for packaged equipment with integral isolators, single manufacturer will select and furnish isolation required.
      b. Deflections indicated will be minimum actual static deflections for specific equipment supported.
      c. Isolator Stability:
         1) Size springs of sufficient diameter to maintain stability of equipment being supported with minimum horizontal to vertical stiffness ratio not less than 1:1. Spring diameters will be not less than 0.8 of the compressed height at rated load.
         2) Springs will have minimum additional travel to solid equal to 50 percent of the rated deflection.
         3) Springs will support 200 percent of rated load when fully compressed without deformation or failure.
      d. Maximum Allowable Vibration Levels: Peak vibration velocities not to exceed 0.08 in/sec. correct equipment operating at vibration velocities that exceed this criteria.
   2. Seismic Restraint:
      a. Seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure will be designed to resist total design seismic force prescribed in local building code:
         1) Floor- or roof-mounted equipment weighing 400 pounds or greater.
         2) Suspended, wall-mounted or vibration isolated equipment weighing 20 pounds or greater.
         3) Housekeeping slabs: provide reinforcement and anchorage to building structure.
      b. Where required, seismic sway bracing of suspended piping will meet the following:
         1) Pipe runs requiring seismic bracing will have a minimum of two traverse braces and one longitudinal brace. A longitudinal (or a traverse) brace at 90 degree change in direction may act as traverse (or longitudinal) brace if located within 2-feet of change in direction.
         2) Seismic bracing may not pass through seismic separation joint. Pipe runs that pass through seismic separation joints must be restrained within 5-feet of both sides of the separation.
3) Seismic brace assembly spacing will not exceed 40-feet transverse and 80-feet longitudinal.

c. Seismic sway bracing of suspended piping will be performed for the following:
1) Piping 4-inches nominal diameter and larger, all cast iron and PVC piping and trapeze systems with total aggregate weight of 10 pounds/foot or greater.

d. Seismic restraints may be omitted from suspended piping if the following conditions are satisfied:
1) For piping supported by individual rod hangers 12-inches or less in length from top of pipe to bottom of structural support. Top connections to structure will have swivel joints, eye bolts, or vibration isolation hangers for the entire length of the system run.
2) Lateral motion of the system will not cause damaging impact with surrounding systems or cause loss of system vertical support.
3) System must be welded steel pipe, brazed copper pipe, or similar ductile material with ductile connections.

e. Seismic restraints, including anchors to building structure, will be designed by registered professional structural engineer licensed in state of California. Design will include:
1) Number, size, capacity, and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both unit to curb and curb to structure.
2) Number, size, capacity, and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations, test data verifying the horizontal and vertical ratings of the seismic restraint devices.
3) Number, size, capacity, and location of braces and anchors for suspended piping and ductwork on as-built plan drawings.
4) Maximum seismic loads will be indicated on Drawings at each brace location. Drawings will bear stamp and signature of registered professional structural engineer who designed layout of braces.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vibration Isolation:
1. Amber-Booth.
2. California Dynamics Corporation.
3. Mason Industries, Inc.
5. Vibro-Acoustics.
6. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.
7. Or equal.

B. Seismic Bracing/Restraint Devices/Systems for Equipment and Piping:
1. Amber-Booth.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.
4. Hilti, Inc.
5. Mason Industries, Inc.
7. Unistrut.
8. ISAT, Inc.
9. Or equal.

2.2 VIBRATION ISOLATION

A. Type 1 - Neoprene Pad: Rubber or neoprene waffle pads, single layer, 5/16-inch thick with pattern repeating on 1/2-inch centers; 40 to 50 durometer hardness; maximum loading 50 PSI, 1/4-inch thick steel load distribution plate. Mason Type SWM.

B. Type 2 - Neoprene Mount: Double-deflection type, with steel or ductile-iron housing containing two separate and opposing, oil-resistant rubber or neoprene elements, factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Minimum static deflection of 0.20-inches. Mason Type BR.

C. Type 3 - Spring: Freestanding, laterally stable, open-spring isolators, factory drilled for bolting to structure and bonded to 1/4-inch thick rubber isolator pad attached to baseplate underside, mounts with leveling bolts. Mason Type SLFH.

D. Type 4 - Spring with Restraints: Laterally stable, open-spring isolators, factory drilled for bolting to structure and bonded to 1/4-inch thick rubber isolator pad attached to baseplate underside; mounts with leveling bolts; steel or cast iron housing for directional seismic snubbing with resilient vertical-limit stops. Mason Type SLR or SSLFH.

E. Type 5 - Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression; designed for 30-degree angular movement before hanger-rod misalignment without binding; seismic rebound washer; 1-inch minimum deflection. Mason Type PC30N.

F. Seismic Snubbers: Directional interlocking steel members restrained by one-piece molded neoprene bushing, minimum of 3/4-inch thick with minimum 1/8-inch air gap in all directions, capable of withstanding 3 times the rated load capacity. Mason Type Z-1225.

2.3 SEISMIC BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT AND PIPING

A. General Requirements for Restraint Components: Rated strengths, features, and applications will be as defined in reports by agency acceptable to authorities having jurisdiction.
PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Vibration isolators and seismic restraint systems must be installed in strict accordance with manufacturers written instructions and certified submittal data.
   2. Set floor-mounted equipment on 4-inch-high concrete housekeeping pads. Extend pad 6-inches beyond footprint of equipment in each direction.
   3. Provide mounts for equipment installed outdoors for wind loads of 30 lbs. psf applied to any exposed surface of isolated equipment.
   4. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.
   5. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances will isolation efficiency be destroyed when bolting the isolators to floor.
   6. Building Penetrations: Isolate water piping penetrating wall, ceilings, floors or shafts from the structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe at equipment room wall.
   7. Pipe Hangers in Equipment Rooms: Support water and gas piping connected to rotating equipment within equipment rooms on spring and neoprene hangers. The first three hangers from a piece of vibrating equipment are to have a minimum of 1/2 static deflection of equipment isolators. Other isolators should have a minimum of 1/4 static deflection of equipment isolators.

3.2 VIBRATION ISOLATION EQUIPMENT INSTALLATION

A. Install isolation as indicated on Drawings by type and location and where indicated below.

B. Isolation Mounts:
   1. Position vibration isolation hanger elements as high as possible in hanger rod assembly but not in contact with building structure. Install hangers so that hanger housing may rotate full 360 degrees about rod axis without contacting any object.
2. Where parallel running pipes are hung together on a trapeze which is isolated from the building, provide isolator deflections for largest determined by provisions for pipe isolation. Do not mix isolated and non-isolated pipes in the same trapeze.

3. Install Type 3 and 4 isolators such that installed and operating heights of vibration isolated equipment is identical. Install limit stops so that they are out of contact during normal operation.

4. Adjust leveling bolts and hanger rod bolts so isolated equipment is level and in proper alignment with connecting pipes.

C. Isolating Pipe Hangers:
   1. Install on compressed air and water piping connected to rotating equipment in the mechanical rooms. Provide isolating hanger supports for each piece of isolated equipment outside of mechanical rooms and where indicated.
   2. Isolated equipment items include base mounted pumps and line mounted pumps.

D. Other Inertia Bases: Unless otherwise indicated, provide a minimum operating clearance of 1-inch between structural steel frames and the concrete housekeeping pad or floor beneath equipment. Position isolator mounting brackets so that the required clearance is maintained.

E. Vibration isolators must not cause change of position of equipment or piping which would stress piping connections or misalign shafts or bearings.

F. Vibration isolators and seismic restraint systems must be installed in strict accordance with manufacturers written instructions and certified submittal data.

G. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances will isolation efficiency be destroyed when bolting the isolators to floor.

H. Anchorage: Adequately anchor or brace plumbing equipment and piping to resist displacement due to seismic action, include snubbers on equipment mounted on spring isolators, pumps and the like.

3.3 SEISMIC RESTRAINTS

A. General:
   1. Install and adjust seismic restraints so that equipment and piping supports are not degraded by restraints.
   2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.

B. Supported Equipment: Each vibration isolation frame for supported equipment will have a minimum of four seismic snubbers mounted as close as possible to vibration isolators and/or frame extremities.

C. Bracing of Pipes: Branch lines may not be used to brace main lines.

D. Suspended Equipment and Piping Cable Method:
1. Cables will be adjusted to the degree of slackness approved by Structural Engineer of Record.

2. Uplift and downward restraint nuts and washers for Type 5 spring hangers will be adjusted so that there is a minimum 1/4-inch clearance.

E. Vibration isolators and seismic restraint systems must be installed in strict accordance with manufacturers written instructions and certified submittal data.

END OF SECTION
SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Plastic Nameplates
   2. Tags
   3. Plastic Pipe Markers

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, submit Valve Schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals. Provide schedules organized as follows:
   1. Equipment Type:
      a. Identification:
      b. Background:
         1) Size:
         2) Color:
      c. Lettering:
         1) Size:
         2) Color:

C. For renovations or expansions of existing systems, coordinate with Owner and develop valve schedule on existing schedule naming and format.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

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B. In addition, meet the following:
   1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
   2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22, Plumbing Sections. Where more than a single type is specified for application, provide single selection for each product category.

B. Plastic Nameplates:
   1. Brady Corporation
   2. Or equal.

C. Tags:
   1. Brady Corporation
   2. Brimer
   3. Champion America Inc.
   4. Craftmark
   5. Seton Identification Products
   6. Or equal.

D. Plastic Pipe Markers:
   1. Brady Corporation
   2. Brimer
   3. Champion America Inc.
   4. Craftmark
   5. Seton Identification Products
   6. Or equal.

2.2 PLASTIC NAMEPLATES

A. Description: Engraving stock melamine plastic laminate 1/8-inch thick, engraved with engraver's standard letter style of the sizes and wording indicated.
   2. Letter Height: 1/2 inch (13 mm).
   4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.

6. Signage for hot water outlets on 140 degree F hot water systems not protected by ASSE 1070 mixing valves; hose bibbs, janitor sinks, and fixtures used by trained personnel.
   a. Manufacturer's standard 1/8-inch thick engraved plastic laminate signage 4 by 4-inches.
   b. Letter Color: Red.
   c. Letter Height: 1/2 inch (13 mm).
   d. Background Color: White.
   e. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2-inch diameter.

B. Metal Tags: Polished Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.

C. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.

D. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

E. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.

F. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
   1. Size: Approximately 4 by 7-inches.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

2.4 PLASTIC PIPE MARKERS


B. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
C. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Lettering and Graphics:
   1. General: Coordinate names, abbreviations and other designations used in plumbing identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
   2. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).

B. Preparation: Degrease and clean surfaces to receive adhesive for identification materials.

C. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

D. Install valve schedule at each mechanical room.

E. Access Doors: Provide markers on each access door and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions.

3.2 PLASTIC NAMEPLATES

A. Identify pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.

B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners.

3.3 TAGS

A. Small devices, such as in-line pumps, may be identified with tags. Use metal tags on piping 3/4-inch diameter and smaller.

B. Identify valves in main and branch piping with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.
C. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.

D. Tag balancing valves with balanced GPM or CFM indicated after balancing is completed and accepted.

E. Install tags with corrosion resistant chain.

### 3.4 PLASTIC PIPE MARKERS

A. Install plastic pipe markers in accordance with manufacturer's instructions.

B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

C. For exterior underground piping installations, install underground plastic pipe markers with tracer wire 6 to 8-inches below finished grade directly above buried pipe.

D. Identify piping, concealed or exposed, with plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

**END OF SECTION**
SECTION 22 05 93

TESTING, ADJUSTING, AND BALANCING FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Balancing water flow within distribution systems of all Division 22, Plumbing Sections, including sub-mains, branches, and terminals, to indicated quantities according to specified tolerances.
   2. Adjusting plumbing systems to provide indicated quantities.
   3. Verifying that automatic control devices are functioning properly.
   4. Reporting results of the activities and procedures specified in this Section.

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Submittal 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Acceptable Balance Firm:
      a. General:
         1) Procure services of independent Testing, Adjusting, and Balancing (TAB) agency to balance, adjust and test water circulating. Minimum Experience: 5 years.
      b. Industry Standards: Testing and Balancing will conform to NEBB, American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), and American National Standards Institute (ANSI) as follows:
         2) ASHRAE: Comply with recommendations pertaining to measurements, instruments, and TAB.
      c. Test Observation: If requested, conduct tests in the presence of the Architect or the Architect's representative.
2. Provide proof of testing agency having successfully completed at least five projects of similar size and scope.
3. Code Compliance: Perform tests in the presence of the Authority Having Jurisdiction (AHJ) where required by the Authority Having Jurisdiction (AHJ).
4. Owner Witness: Perform tests in the presence of the Owners representative.
5. Engineer Witness: The engineer or engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.
6. Simultaneous Testing: Test observations by the Authority Having Jurisdiction (AHJ), the Owner's representative and the engineer's representative need not occur simultaneously.
7. Do not perform TAB work until plumbing equipment has been completely installed and is operating continuously as required.
8. Conduct TAB with clean filters in place. Clean strainers prior to performing TAB.
9. Agent Qualifications: Engage a TAB Agent certified by AABC or NEBB.
10. TAB Conference: Meet with the Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.
   a. Agenda Items: Include at least the following:
      1) Submittal distribution requirements.
      2) TAB plan.
      3) Work schedule and Project site access requirements.
      4) Coordination and cooperation of trades and subcontractors.
      5) Coordination of documentation and communication flow.
11. Certification of TAB Reports: Certify the TAB field data reports. This certification includes the following:
   a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
12. TAB Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."
14. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
15. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
16. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Section 01740, Warranties/Guaranties.
1.7 DEFINITIONS

A. Adjust: To regulate fluid flow rate at the equipment.

B. Balance: To proportion flows within the distribution system, including sub mains, branches, and terminals, according to design quantities.

C. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

D. Report Forms: Test data sheets for recording test data in logical order.

E. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

F. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

G. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

H. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

I. TAB: Testing, Adjusting, and Balancing.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.


O. CTI: Cooling Tower Institute.

P. NEBB: National Environmental Balancing Bureau.

Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.8 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, controls installers, and other mechanics to operate systems and equipment to support and assist TAB activities.
PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire TAB period. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.

B. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.

C. Non-Owner Occupancy: Complete balancing of building systems prior to Substantial Completion and owner occupancy.

3.2 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
   1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
   2. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of Plumbing systems and equipment.

C. Examine equipment performance data including pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

E. Examine system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
F. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

G. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

H. Examine equipment for installation and for properly operating safety interlocks and controls.

I. Examine automatic temperature system components to verify the following:
   1. Valves, and other controlled devices operate by the intended controller.
   2. Valves are in the position indicated by the controller.
   3. Integrity of valves for free and full operation and for tightness of fully closed and fully open positions.
   4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
   5. Sensors are located to sense only the intended conditions.
   6. Sequence of operation for control modes is according to the Contract Documents.
   7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.

J. Report deficiencies discovered before and during performance of TAB procedures.

K. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:
   1. Permanent electrical power wiring is complete.
   2. Systems are filled, clean, and free of air.
   3. Automatic temperature-control systems are operational.
   4. Isolating and balancing valves are open and control valves are operational.

C. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Attendance is required by installers whose work will be tested, adjusted, or balanced.

D. Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.

3.4 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform TAB procedures on each system according to the procedures contained in AABC national standards or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation for pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
C. Mark equipment settings with paint or other suitable, permanent identification material, including control positions, valve indicators and similar controls and devices, to show final settings.

3.5 ADJUSTMENT TOLERANCES

A. Piping Systems: Adjust to within plus or minus 10 percent of design.

3.6 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings locations where other critical measurements were taken and cross reference location in final report.

3.7 FUNDAMENTAL PROCEDURES FOR PIPING SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 10 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare systems for TAB according to the following, in addition to the general preparation procedures specified above:
   1. Open manual valves for maximum flow.
   2. Check expansion tank liquid level, or air charge if bladder type.
   3. Check makeup-water-station pressure gauge for adequate pressure.
   4. Check flow-control valves for specified sequence of operation and set at design flow.
   5. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.8 FINAL REPORT

A. General: Computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into Sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.
   1. Include a list of the instruments used for procedures, along with proof of calibration.
C. Final Report Contents: In addition to the certified field report data, include the following:
   1. Pump curves.
   2. Field test reports prepared by system and equipment installers.
   3. Other information relative to equipment performance, but do not include approved Shop
      Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in
   the final report, as applicable:
   1. Title page.
   2. Name and address of TAB Agent.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   9. Signature of TAB Agent who certifies the report.
   10. Summary of contents, including the following:
       a. Design versus final performance.
       b. Notable characteristics of systems.
       c. Description of system operation sequence if it varies from the Contract
          Documents.
   11. Nomenclature sheets for each item of equipment.
   12. Notes to explain why certain final data in the body of reports vary from design values.

E. Pump Test Reports: For pumps, include the following data. Calculate impeller size by plotting
   the shutoff head on pump curves.
   1. Unit Data: Include the following:
      a. Unit identification.
      b. Location.
      c. Service.
      d. Make and size.
      e. Model and serial numbers.
      f. Water flow rate in gpm (L/s).
      g. Water pressure differential in feet of head or PSIG (kPa).
      h. Required net positive suction head in feet of head or PSIG (kPa).
      i. Pump rpm.
      j. Impeller diameter in inches.
      k. Motor make and frame size.
      l. Motor horsepower and rpm.
      m. Voltage at each connection.

END OF SECTION
SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Type 1, Glass Wool Pipe Insulation
   2. Type 2, Flexible Elastomeric Insulation
   3. Type 5, Glass Wool Equipment Insulation
   4. Type 7, ADA Accessible Lavatory/Sink Insulation Kit
   5. Accessories
   6. Pipe Fitting Insulation Covers

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and
   Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. Piping insulation products to contain less than 0.1 percent by weight PBDE in all
      insulating materials.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330,
   Submittal Procedures.

B. In addition, provide:
   1. Installer qualifications.
   2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and
      field applied, if any), for each type of product indicated.
   3. Material Test Reports: From a qualified testing agency acceptable to authorities having
      jurisdiction indicating, interpreting, and certifying test results for compliance of
      insulation materials, sealers, attachments, cements, and jackets with requirements
      indicated. Include dates of tests.
   4. Installer Certificates: Signed by the Contractor certifying that installers comply with
      requirements.
   5. Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section
   01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
B. In addition, meet the following:
   1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
   2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
   3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
   4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 FIRE HAZARD CLASSIFICATION

A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.

B. Test pipe insulation in accordance with requirements of current edition of UL "Pipe and Equipment Coverings".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Type 1, Glass Wool Pipe Insulation:
   1. Owens-Corning
   2. Johns Manville
   3. Or equal.

B. Type 2, Flexible Elastomeric Insulation:
   1. Glue:
      a. Armacell LLC Armaflex Low VOC Adhesive
      b. Halstead
      c. Or equal.
   2. Paint:
      a. Armacell LLC Armaflex
      b. Halstead
      c. Or equal.

C. Type 5, Glass Wool Equipment Insulation:
   1. Knauf
   2. Owens-Corning
   3. Johns Manville
   4. Or equal.

D. Type 7, ADA Accessible Lavatory/Sink Insulation Kit:
1. IPS/Truebro
2. McGuire/Pro-Wrap
3. Plumberex/Pro-Extreme
4. Brocar Trap Wrap
5. Or equal.

E. Accessories:
1. ITW Insulation Systems
2. Or equal.

F. Pipe Fitting Insulation Covers:
1. Zeston Johns Manville
2. ITW Insulation Systems
3. Or equal.

2.2 TYPE 1, GLASS WOOL PIPE INSULATION

A. Glass Fiber: ASTM C547 Type I and IV; rigid molded, noncombustible.
1. Thermal Conductivity Value: 0.27 BTU*in/(hr*sf*F) at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.
3. Vapor Retarder Jacket: White Kraft paper reinforced with glass fiber and bonded to aluminum foil, with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.3 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

A. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.
1. Thermal Conductivity Value: 0.25 BTU*in/(hr*sf*F) at 75 degrees F.
2. Maximum Service Temperature of 220 degrees F.
4. Maximum Smoke Developed: 50 (3/4-inch thick and below).
5. Connection: Waterproof vapor retarder adhesive as needed.
6. UV Protection: UV outdoor protective coating per manufacturer's requirements.

B. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam.

C. Paint: Nonhardening high elasticity type, specifically manufactured as a protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather.

2.4 TYPE 5, GLASS WOOL EQUIPMENT INSULATION

A. Flexible Glass Wool Blanket: ASTM C612; flexible.
1. Thermal Conductivity Value: 0.24 BTU*in/(hr*sf*F) at 75 degrees F.
2. Maximum Service Temperature: 450 degrees F.

2.5 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

A. P-traps, trap arms, tail pieces, hot water and cold water insulating guards. Molded closed cell insulation with vinyl cover and nylon fasteners, paintable. Thermal conductivity; K = 1.17 (BTU*in/(hr*sf*F) at 75 degrees F mean temperature. Provide accessories as required for
complete installation covering all exposed waste piping, water piping, stops and supplies. Color white.

2.6 ACCESSORIES

A. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

B. Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have same flame and smoke component ratings as insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

2.7 PIPE FITTING INSULATION COVERS


PART 3 - EXECUTION

3.1 GENERAL INSTALLATION INFORMATION

A. Verification of Conditions:
   1. Do not apply insulation until pressure testing and inspection of piping has been completed.
   2. Examine areas and conditions under which insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Preparation: Clean and dry surfaces to be insulated.

C. Installation:
   1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
   2. Piping and Equipment:
      a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.
      b. Cover insulation on pipes above ground, outside of building, with aluminum jacketing. Position lap on bottom of pipe.

D. Provide accessories as required. See Part 2 Article "Accessories" above.
E. Protection and Replacement: Protect installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

F. Labeling and Marking: Provide labels, arrows and color coding on piping. Attach labels and flow direction arrows to jacketing per Section 22 05 53, Identification for Plumbing Piping and Equipment.

G. Piping Surfaces to be Insulated:

<table>
<thead>
<tr>
<th>Item to be Insulated</th>
<th>System Insulation Type</th>
<th>Pipe Size</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Water Piping Above Grade (105F to 140F)</td>
<td>1</td>
<td>Runouts up to 1-1/2-inch (uncirculated branches)</td>
<td>1-inch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mains =&lt;1-1/4-inch</td>
<td>1-inch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mains &gt;1-1/4-inch</td>
<td>1-1/2-inch</td>
</tr>
<tr>
<td>Hot Water Circulation Piping Above Grade (105F to 140F)</td>
<td>1</td>
<td>Runouts up to 1-1/2-inch</td>
<td>1-inch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mains =&lt;1-1/4-inch</td>
<td>1-inch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mains &gt;1-1/4-inch</td>
<td>1-1/2-inch</td>
</tr>
<tr>
<td>Water Piping Exposed to Weather</td>
<td>1, 2</td>
<td>All</td>
<td>1-1/2-inch</td>
</tr>
<tr>
<td>Piping with Heat Tracing</td>
<td>2</td>
<td>&gt;1-1/2-inch</td>
<td>1-1/2-inch</td>
</tr>
<tr>
<td>Above Grade Roof Drain/Overflow Drain Piping</td>
<td>1, 2</td>
<td>All</td>
<td>1/2-inch</td>
</tr>
<tr>
<td>Roof Drain Underbodies</td>
<td>5</td>
<td>N/A</td>
<td>1-inch</td>
</tr>
<tr>
<td>Overflow Roof Drain Underbodies</td>
<td>5</td>
<td>N/A</td>
<td>1-inch</td>
</tr>
<tr>
<td>ADA Accessible Lavatory/Sink</td>
<td>7</td>
<td>All</td>
<td>As Listed</td>
</tr>
<tr>
<td>Storage Tanks</td>
<td>5</td>
<td>All</td>
<td>2-inch</td>
</tr>
<tr>
<td>Condensate Drain Piping</td>
<td>1, 2</td>
<td>All</td>
<td>1/2-inch</td>
</tr>
</tbody>
</table>

3.2 TYPE 1, GLASS WOOL PIPE INSULATION

A. See General Installation Requirements above.
B. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.

C. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

D. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.

E. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 1-1/2-inches and larger (hot and cold piping).

F. Install in accordance with manufacturer's instructions for below grade installation.

3.3 **TYPE 2, FLEXIBLE ELASTOMERIC INSULATION**

A. See General Installation Requirements above.

B. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.

C. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.

D. Flexible Elastomeric Tubing: Slip insulation over piping or if piping is already installed, it should be slit and snapped over piping. Joints and butt ends must be adhered with 520 adhesive.

E. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 1-1/2-inches and larger (hot and cold piping).

F. Install in accordance with manufacturer's instructions for below grade installation.

3.4 **TYPE 5, GLASS WOOL EQUIPMENT INSULATION**

A. See General Installation Requirements above.

B. Apply insulation and accessories to roof drain underbodies per manufacturer's recommendations.

C. Roof Drain/Overflow Drain Underbodies: Cover underside of drain body with glass wool insulation; attached with adhesive and supported externally with 26 gauge galvanized flat strapping anchored to structure.
D. Storage Tanks: Cover with glass wool, 2-inches thick. Finish with canvas jacket and adhesive. Overlap joints minimum of 4-inches. Apply two coats latex paint; color selected by Architect.

3.5 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

C. Provide lavatory/sink insulation kit. Install on waste fittings, hot and cold water stops and supplies.

3.6 ACCESSORIES

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

C. Provide and install accessories for all insulation types listed in this Section.

3.7 PIPE FITTING INSULATION COVERS

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

END OF SECTION
SECTION 22 08 00
COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. See Section 01810/01 91 13, General Commissioning Requirements, for overall objectives and comply with requirements.
      a. This section covers the Contractor's responsibilities for commissioning; installer responsible for installation of a particular system or equipment item to be commissioned is responsible for commissioning activities relating to that system or equipment item.
      b. Pre-Functional Checklist and Functional Test requirements specified in this Section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

B. Meet requirements of ASHRAE Guideline 0, The Commissioning Process.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide Pressure Tests, Flushing Reports, and Startup Reports. Submit for approval of Commissioning Authority.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Section 01740, Warranties/Guaranties.

B. In addition, provide:
1. Commissioning, inspecting, and testing will not modify terms or time periods of mechanical equipment, systems, and controls warranties including related equipment and system, and adjacent work.

2. Control system warranty period starts from date of Commissioning Agent acceptance.

1.7 COORDINATION

A. Reference Section 01 91 13, General Commissioning Requirements for requirements pertaining to coordination during the commissioning process.

1.8 PURPOSE

A. Purpose of commissioning process is to provide Owner assurance that systems have been installed in prescribed manner and will operate within performance guidelines. Commissioning is intended to enhance quality of system startup and aid in orderly transfer of systems to beneficial use by Owner.

B. Commissioning procedures and results will be observed by Commissioning Authority or Owner's staff. Contractor is expected to verify functional readiness of systems to be tested prior to performing the tests in presence of Owner's witness. A high rate of test failure will indicate that Contractor has not adequately verified readiness of systems.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become property of Owner.

B. Specialized tools, test equipment, and instruments required to execute Start-up, checkout, and testing of equipment are to be of sufficient quality and accuracy to test and/or measure system performance within specified tolerances. A testing laboratory must have calibrated its test equipment within the previous 12 months. Calibration to be NIST traceable. Contractor must calibrate test equipment and instruments according to manufacturer's recommended intervals and whenever the test equipment is dropped or damaged. Calibration tags must be affixed to the test equipment or certificates readily available.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become property of Owner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cooperate with Commissioning Authority in development of the Pre-Functional Checklists and Functional Test Procedures.
B. As part of required submittals for contract, within three months of award of contract, submit for each piece of equipment and controls, manufacturer's startup and installation procedures as well as controls point-to-point and sequence checkout and provide in checklist format.

C. Furnish additional information requested by the Commissioning Authority.

D. Prepare a preliminary schedule for Plumbing pipe systems testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update schedule as appropriate.

E. Notify Commissioning Authority when pipe system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that Commissioning Authority has scheduling information needed to efficiently execute commissioning process.

F. Put equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

G. Provide temperature and pressure taps in accordance with Contract Documents.

H. Provide a pressure/temperature plug at each water sensor which is an input point to control system.

3.2 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the Commissioning Authority.

B. Participate in Plumbing systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the Commissioning Authority.

C. Provide information requested by the Commissioning Authority for final commissioning documentation.

D. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.

E. Prepare preliminary schedule for Plumbing system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system testing, flushing and cleaning, equipment startup, testing and balancing and task completion for Owner. Distribute preliminary schedule to commissioning team members.

F. Update schedule as required throughout the construction period.

G. During the startup and initial checkout process, execute the related portions of the Pre-Functional Checklists for commissioned equipment.

H. Contractor to participate and complete checklists using the Commissioning Authority's web based commissioning software Facility Grid. A desktop, laptop, tablet, or iPad will be required.
I. Assist the Commissioning Authority in verification and Functional Performance Tests.

J. Gather operation and maintenance literature on equipment and assemble in binders as required by the Specifications. Submit to Commissioning Authority 45 days after substantial completion.

K. Coordinate with the Commissioning Authority to provide 48 hour advance notice so that the witnessing of equipment and system startup and testing can begin.

L. Notify the Commissioning Authority a minimum of one week in advance of the time for the start of the balancing work.

M. Participate in, and schedule vendors and contractors to participate in the training sessions.

N. Provide written notification to the CM/GC and Commissioning Authority that the following work has been completed in accordance with the Contract Documents, and that the equipment, systems, and sub-system are operating as required.
   1. Plumbing equipment including domestic water heaters, pumps, plumbing fixtures, and other equipment furnished under this Division.
   2. Gas piping, sanitary waste and vent piping, storm drainage piping, sump pumps and automatic sprinkler system.

O. Provide training of the Owner's operating staff using expert qualified personnel, as specified.

P. Reference Section 01 91 13, General Commissioning Requirements, for additional contractor responsibilities.

3.3 OWNER'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for Owner's responsibilities.

3.4 DESIGN PROFESSIONAL'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for the Architect, Mechanical, Electrical, and Plumbing Engineer's responsibilities.

3.5 COMMISSIONING AUTHORITY'S (COMMISSIONING AUTHORITY) RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for the Commissioning Authority's responsibilities.

3.6 TESTING PREPARATION

A. Certify, in writing, to the Commissioning Authority that plumbing instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pre-test setpoints have been recorded.
B. Certify, in writing, that discrepancies discovered during the test and balance process have been
resolved and that testing, adjusting, and balancing is completed.

C. Set systems, subsystems, and equipment into operating mode to be tested (e.g. normal auto
position, normal manual position, unoccupied mode, emergency power and alarm conditions.

D. Inspect and verify the position of each device and interlock identified on checklists.

E. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during
each mode operation.

3.7 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of Plumbing.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine capabilities of the control system toward completing TAB.

D. Provide necessary unique instruments and instruct TAB technicians in their use; such as
handheld control system interface, etc.

E. Have required Pre-Functional Checklists, calibrations, startup and component Functional Tests
of the system completed and approved by Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate controls to assist TAB technicians or
provide sufficient training for TAB technicians to operate system without assistance.

3.8 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction
of Commissioning Authority.

B. Scope of Plumbing testing to include entire Plumbing installation. Testing to include
measuring capacities and effectiveness of operational and control functions.

C. Test operating modes, interlocks, control responses, and responses to abnormal or emergency
conditions, and verify proper response of building automation system controllers and sensors.

D. The Commissioning Authority along with the Plumbing contractor, balancing subcontractor to
prepare detailed testing plans, procedures, and checklists for Plumbing systems, subsystems,
and equipment.

E. Tests will be performed using design conditions whenever applicable.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to
test under design conditions. Before simulating conditions, calibrate testing instruments.
Provide equipment to simulate loads. Set simulated conditions as directed by the
Commissioning Authority and document simulated conditions and methods of simulation.
After tests, return settings to normal operating conditions.
G. The Commissioning Authority may direct that setpoints be altered when simulating conditions is not practical.

H. The Commissioning Authority may direct that sensor values be altered with a signal generator when design or simulating conditions and altering setpoints are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the Plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

3.9 PLUMBING SYSTEMS, SUBSYSTEMS AND EQUIPMENT TESTING PROCEDURES

A. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: Test requirements are specified in Division 22, Plumbing Piping sections. Plumbing Contractor to prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the Commissioning Authority. Plan should include the following.
   1. Sequence of testing procedures for each section of pipe to be tested, identified by pipe zone or sector identifications marker. Markers to be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors to be formatted to allow each section to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
   2. Description of equipment for flushing operations.
   3. Minimum flushing velocity.

B. Functional Performance Tests: Tests will be fully documented with test procedures, expected results for each procedure, and documented in either pass or fail. Tests are written by the Commissioning Authority and performed by the Contractor. The Commissioning Authority documents the results of the test.

3.10 DEFICIENCIES / NON-CONFORMANCE AND COST OF RETESTING

A. The Commissioning Authority documents the results of the tests. Corrections of minor deficiencies identified are made during the tests at the discretion of the Commissioning Authority. The Commissioning Authority documents the testing results on the Functional Performance Testing document. Deficiencies or non-conformance issues are noted and reported to the GC and Owner via the Master Cx Issues/Resolutions Log. The Contractor with then correct deficiencies, notify the Commissioning Authority of the correction, and then schedule retesting of the issue with the GC and Commissioning Authority. For areas in dispute of the issue between the Commissioning Authority and Contractor to go directly to the A/E. A/E to provide direction of the design intent and expected result to clear up the dispute.

B. If the Plumbing contractor fails to demonstrate proper sequence of operation in any of the second round of Functional Performance Tests, the Commissioning Authority's costs for witnessing further demonstration of that test procedure may be assigned to the Plumbing contractor by the Owner as a deduct to their contracted price. The Plumbing contractor will not be responsible for costs related to failure due to design or other factors beyond their control,
though it is expected to call any design concerns (and other factors beyond their control that might cause failure) to the attention of the GC and Commissioning Authority.

C. Reference Section 01 91 13, General Commissioning Requirements for additional contractor responsibilities.

3.11 OPERATION AND MAINTENANCE MANUALS

A. See Section 01785, Operation and Maintenance Data, for additional requirements.

B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.12 DEMONSTRATION AND TRAINING

A. See Section 01820, Demonstration and Training, for additional requirements.

B. Demonstrate operation and maintenance of Plumbing systems to Owner's personnel; if during any demonstration, system fails to perform in accordance with information included in Operations and Maintenance (O&M) manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Pre-Functional Checklists and demonstrations to Commissioning Authority during Functional Testing.

D. Training:
   1. Submit a written training plan to the Owner and Architect/Engineer for review and approval. Contractor's training plan to cover the following elements:
      a. Equipment included in training.
         1) Intended audience.
         2) Location of training.
         3) Objectives.
      b. Subjects covered.
      c. Duration of training on each subject.
      d. Instructor for each subject.
      e. Methods (classroom lecture, video, Site walk-through, actual operational demonstrations, written hand outs, etc.).
      f. Instructors and qualifications.
   2. Contractor is to have the following training responsibilities:
      a. Provide a training plan ten calendar days prior to the scheduled training, in accordance with Section 01820, Demonstration and Training.
      b. Provide Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned mechanical equipment or system.
      c. Training to start with classroom sessions, if necessary, followed by hands-on training on each piece of equipment, which will illustrate the various modes of operation, including start-up, shutdown, fire/smoke alarm, power failure, etc.
d. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

e. The appropriate trade or manufacturer's representative will provide the instructions on each major piece of equipment. This representative may be the Start-up technician for the piece of equipment, the installing contractor, or the manufacturer's representative. Practical building operating expertise, as well as in-depth knowledge of modes of operation of the specific piece of equipment, is required. More than one party may be required to execute the training.

E. Provide the services of manufacturer representatives to assist instructors where necessary.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Buried Within 5-feet of Building
   2. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Above Grade
   3. Pump Waste Pressure Piping (Pumped Discharge)
   4. Water Piping, Buried Within 5-feet of Building
   5. Hot and Cold Domestic Water Above Grade
   6. Condensate Piping
   7. Primer Piping
   8. Piping Specialties
   9. Cleanouts

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. NSF 61, Annex G.
   2. Steel pipe to conform to ASTM and ANSI Standards as specified in this Section.
   3. Copper piping to conform to ASTM B88, B306 and B208 and the standards of Copper Development Association (CDA), and American Welding Society (AWS).
   5. Manufacturer's Standards Society (MSS) for valving and support reference standard.
   6. American Water Works Association (AWWA) for Valving Assembly Standards.
   7. American Society of Sanitation Engineers (ASSE) for Valving Standards.
   8. American National Standards Institute (ANSI) for Piping Standards.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
1.6 **WARRANTY**

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Section 01740, Warranties/Guaranties.

**PART 2 - PRODUCTS**

2.1 **MANUFACTURERS**

A. See component manufacturers listed in individual articles below.

B. Cerro

C. Dodge Phelps

D. Tyler

E. Charlotte

F. Spears

G. Nibco

H. American-USA

I. Sioux Chief

J. Or equal.

K. Cleanouts:
   1. J.R. Smith
   2. Zurn
   3. Wade
   4. Watts
   5. Sioux Chief
   6. Or equal.

L. Firestopping Penetrations in Fire Rated Wall Floor Assemblies:
   1. Hilti
   2. Proset
   3. Or equal.

2.2 **GENERAL**

A. Provide pipe, tube and fittings of the same type, fitting requirements, grade, class and the size and weight indicated or required for each service, as indicated in other Division 22, Plumbing Specifications. Where type, grade, or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.
B. Manufactured materials delivered, new to the project site and stored in their original containers.

C. Product Marking: Each item to be furnished with legible markings indicating name brand and manufacturer, manufacturing process, heat number and markings as required per ASTM and UL/FM Standards.

2.3 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5- FEET OF BUILDING

A. PVC Pipe: ASTM D 2665 IPS Schedule 40, Solid wall for waste and drainage only. Use of foam core ASTM F891 is approved for vent piping only.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement, 2-step glue (primer and glue) is required.

2.4 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

   1. Fittings: Cast iron.
   2. Coupling Assembly:

B. Copper Tube: ASTM B 306, DWV

2.5 PUMP WASTE PRESSURE PIPING (PUMPED DISCHARGE)

A. Above Grade: Type "L" copper with solder joints.

B. Below Grade: Type "L" copper with brazed joints.

2.6 WATER PIPING, BURIED WITHIN 5- FEET OF BUILDING

A. Copper Pipe: ASTM B88, hard drawn, Type K (A).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

   1. Fittings: Ductile or gray iron, standard thickness.

2.7 HOT AND COLD DOMESTIC WATER ABOVE GRADE

A. Copper Tube: 3-inches and above. ASTM B88 (ASTM BA88m), Type L (B), Drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
B. Copper Tube: 2-1/2-inches and smaller. ASTM B88 (ASTM B88M), Type L (B), Drawn.
   1. Fittings: ASME B16.18 copper.

2.8 CONDENSATE PIPING

A. Copper Tube: ASTM B 88 (ASTM B898M), Type L (B) or M (C)

B. Piping for drainage of condensate from combustion fuel sources (such as condensing boilers and water heaters) is to be chemical resistant piping as noted in this Section for area of application.

2.9 PRIMER PIPING

A. Above Ground: Type L hard-drawn copper tubing with wrought sweat fittings and soldered joints.

B. Belowground: Type L soft annealed copper tubing with wrought sweat fittings and brazed joints.

2.10 PIPING SPECIALTIES

A. Pipe Escutcheons:
   1. Provide pipe escutcheons as specified with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime zinc base paint finish for unoccupied areas.
   2. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass or sheet brass escutcheons, solid or split hinged.
   3. Pipe Escutcheons for Dry Areas: Provide stainless steel escutcheons, solid or split hinged.

B. Low Pressure Y-Type Pipeline Strainers:
   1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 percent of the working pressure of piping system with Type 304 stainless steel screens made with 8mm perforations at 233 perforations per square millimeter.
   2. Threaded Ends, 2-inch and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with plus.
   3. Flanged Ends, 2-1/2-inch and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with hose bibb.

C. Air Vent with Valves:
   1. Install automatic air vents in all closed and open-loop water systems at high points and at any other point necessary to free system of air. A shut-off valve to be provided in riser to
each automatic vent valve to facilitate servicing. Manual type vent may be used in lieu of automatic type, where specifically shown on the Drawings.

2. Manufacturer: Hoffman #79.

D. Dielectric Waterways:
1. Provide standard products recommended by manufacturers in service indicated, which effectively isolate ferrous from non-ferrous piping (eliminating electrical conductance) to prevent galvanic action and stop corrosion.
2. Provide dielectric waterways or brass nipple fitting for transitions between dissimilar metal piping.

E. Unions:
1. Unions to comply with the following schedule:
   a. Black Steel, 2-inch and smaller: 150 PSI screwed malleable iron, ground joint, brass to iron seat.
   b. Black Steel, 2-1/2-inch and larger: 150 PSI cast iron screwed flanged, flat faced, full faced gasket.
   c. Soldered Copper or Brass Pipe, 2-inch and smaller: 150 PSI cast bronzed or copper, ground joint, non-ferrous seat with soldered ends.
   d. Screwed Copper or Brass Pipe, 2-inch and smaller: 150 PSI cast brass, ground joint, brass to brass seat, threaded ends.
   e. Flanged Copper or Brass Pipe, 2-1/2-inch and larger: Two 150 PSI cast bronze flanges.
   f. Manufacturer: EPCO, Mueller or Stanley G. Flagg or Watts or equal.

F. Flexible Piping Connectors - Expansion Loops or Seismic Joints:
1. Provide flexible expansion loops of size and material noted on Drawings. Flexible loops to be designed to impart no thrust loads on the anchors. The loop consists of two flexible sections of hose and braid, two 90 degree elbows, and a 180 degree return. Loops to be installed in a neutral, precompressed, or preextended condition as required for the application. Loops installed hanging down to have a drain plug. Loops installed straight up may be fitted with an automatic air release valve to purge air from the high point of the loop. Loops installed in any position other than hanging down must have the 180 degree return supported.
2. Copper Pipe: Copper fittings, bronze hose and braid sweat solder ends, Metraloop Series MLS 8000.
3. Steel Pipe: Schedule 40 carbon steel fittings, stainless steel hose and braid,
4. Threaded Eds: Metraloop Series MLT 80000
5. Flanged Ends: Metraloop Series MLF 80000
6. Welded Ends: Metraloop Series MLW 80000
7. Grooved Ends: Metraloop Series MLG 80000
8. Gas Lines, CSA Approved: Metraloop - Gas MLT or MLF Series.
9. Vertical and horizontal straight run hot water and domestic hot water recirculation piping exceeding 1,000-feet to be provided with expansion joints by Mason, Flexionics or Shur Fit. Installation to be per manufacturer's installation directions.
2.11 CLEANOUTS

A. General: Locate cleanouts as shown on Drawings and as required by local code. Cleanouts same size as pipe except that greater than 4-inches will not be required. Plastic components not allowed, except unless specifically noted.

B. Types:
   3. Concrete Floor Cleanout (General): J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.
   4. Parking, Drives and Concrete Floor Cleanouts (Heavy Load): J. R. Smith 4100 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Underground Piping Systems Examination:
   1. Verify that excavations are to required grade, dry, and not over-excavated.

B. General:
   1. Perform necessary excavation and backfill required for installation of plumbing work. Repair piping or other work at no expense to Owner.
   2. Water: Keep excavations free of standing water. Reexcavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
   3. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of testing laboratory.
   4. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (muck, peat), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material. Adequate width of trench for proper installation of piping or conduit.
   5. Support Foundations:
      a. Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
b. Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.

c. Foundation Material: Where native material has been removed, place and compact necessary foundation material to form base for replacement of required thickness of bedding material.

<table>
<thead>
<tr>
<th>Material Passing</th>
<th>Class A</th>
<th></th>
<th>Class B</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Max.</td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>3/4-inch Square Opening</td>
<td>27</td>
<td>47</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
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d. Bedding Material: Full bed piping on sand, pea gravel, or 3/4-inch minus crushed rock. Place minimum 4-inch deep layer of sand, pea gravel, or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide firm foundation.

6. Backfilling:
   a. Following installation and successful completion of required tests, backfill piping in lifts.
      1) In "Pipe Zone" place backfill material and compact in lifts not to exceed 6-inches in depth to height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
      2) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
   b. Backfill Material:
      1) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
      2) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

7. Compaction of Trench Backfill:
   a. Where compaction of trench backfill material is required, use one of following methods or combination thereof:
      1) Mechanical tamper,
      2) Vibratory compactor, or
      3) Other approved methods appropriate to conditions encountered.
   b. Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

C. General Installation:
   1. Work performed by experienced journeyman plumbers. No exceptions.
   2. Provide access panels for concealed valves, shock arrestors, trap primers and the like.
3. Install pipes and pipe fittings in accordance with recognized industry practices and manufacturer's recommendations.


5. Locate piping runs, as indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1-inch clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view by locating it in column enclosures, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.

a. Do not run piping through transformer vaults, telephone, elevator, electrical or electronic equipment spaces or enclosures unless indicated on Drawings.

b. Concealed Piping Above Suspended Ceiling: Plan and coordinate to avoid interferences; install to maintain suspended ceiling heights shown on Architectural Drawings. Allow sufficient space above removable ceiling panels for panel removal. Locate piping so that valves are visible and accessible within 24-inches horizontally and vertically from point of access to the ceiling space. Provide plenum rated materials for ceiling spaces which are being used as plenums.

c. Exposed Work: Run pipes parallel to the closest wall unless otherwise shown on Drawings; maintain maximum headroom; avoid light fixtures.

d. Insulation Space Allowance: In piping work, allow space for pipe insulation and jackets. If interferences occur, move the piping to accommodate insulation thickness specified.

e. Pipe Lengths: Do not use short lengths or nipples at locations where a full length of pipe will fit.

f. Alignment Prior to Supporting and Anchoring: Place piping in proper alignment and position prior to connection to anchors, expansion loops, and equipment. Furnish jacking devices, temporary steel structural members, and assembled structures as necessary. Remove temporary equipment and structures supplied by contractor at completion; such items to remain Contractor property.

g. Valve and Equipment Connections: Piping not to place undue stress on flanged valves and equipment connections. Mating flange faces to be true and parallel to each other and not to require springing of piping for assembly. Pipe hangers and supports to carry the full weight of the pipe and fluid.

h. Piping Leaks: Correct immediately; use new materials; leak-sealing compounds or peening not permitted.

i. Pressure Ratings of Fittings, Valves, and Devices in Piping Systems: Pressure rating to be equal to or greater than the maximum working pressure of the system.

j. Equipment Vents and Drains: Provide for coils and vessels which contain water. Provide isolation valves and outlet valves at piping high and low points to permit venting and draining of the vessel without venting and draining connected piping. Provide hose connections and caps on drain lines.
k. Escutcheon Plates: Where exposed insulated and uninsulated piping passes through walls, floors or ceilings; provide spring clip type. Provide plates on both sides of wall or floor.

D. Testing:
   1. General:
      a. Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.
      b. Notify Architect and local Plumbing Inspector 2 days before tests.
      c. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
      d. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
      e. Send test results to Architect for review and approval and include in Operation and Maintenance Manual.
   2. Testing of Pressurized Systems:
      a. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
      b. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.
   3. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

E. Corrosive Soil Conditions:
   1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's recommendations.
   2. Obtain and review project soils report for verification of requirements concerning corrosive soils.

F. Protection:
   1. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping, ductwork, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore to its original condition or replace fixtures, equipment or apparatus damaged prior to final acceptance of work.

G. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

H. Piping to be cut squarely, free of rough edges and reamed to full bore. Piping to be fully inserted into fittings.

I. Provide joints of type indicated in each piping system.

J. Thread pipe in accordance with ANSI/ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

K. Sleeves:
   1. Pipe Sleeves:
      a. Layout work in advance of pouring concrete, furnish, and set sleeves necessary to complete work.
      b. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with non-shrinking grout or approved caulking compound (Except DWV Piping penetrating a concrete Slab set on Finish Grade), provide "Link-Seal" sleeve sealing system for concrete/slab penetrations which are below grade. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements
      c. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Provide modular link sealing system for concrete penetrations which are below grade. Caulk/seal piping passing through fire-rated assemblies per local AHJ requirements.
      d. Beam Sleeves: Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Indicate penetrations on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Plumbing Drawings are diagrammatic. Offset piping as required to meet these limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
   2. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
      a. Install fabricated pipe sleeve.
      b. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification.
      c. Seal each end airtight with a resilient nonhardening seal per code.
   3. Piping penetrations through fire-rated (1 to 3 hour) assemblies:
      a. Select and install pre-engineered pipe penetration system in accordance with UL listing and manufacturer's recommendation.
b. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E84.

3.2 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

A. Excavation and Backfill:
   1. See 3.01B. above.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

C. Corrosive Soil Conditions:
   1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.

D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

E. Sanitary and Storm Drainage:
   1. Piping to be graded at a uniform pitch of 2 percent unless otherwise noted on Drawings.
   2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on direct waste or drain piping exceeding 60-inches.
   3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00.
   4. Drains:
      a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Arrange for flooring to be sloped to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
      b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
   5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
   6. Heat trace and insulate P-traps exposed to freezing conditions. Provide heat trace and electronic components to Division 26 for installation.
   7. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.

3.3 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

A. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system
to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

B. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
   1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

C. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Joints to be cleaned by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meets CDA standard test method 1.0 and ASTM B813-91. Solder to be applied until a full fillet is present around the joint. Solder and flux not to be applied in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.

D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

E. Sanitary and Storm Drainage:
   1. Piping to be graded at a uniform pitch of 2 percent unless otherwise noted on Drawings.
   2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on direct waste or drain piping exceeding 60-inches.
   3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00.
   4. Drains:
      a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Arrange for flooring to be sloped to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
      b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
   5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
   6. Heat trace and insulate P-traps exposed to freezing conditions. Provide heat trace and electronic components to Division 26 for installation.
   7. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.

3.4 PUMP WASTE PRESSURE PIPING (PUMPED DISCHARGE)

A. Excavation and Backfill:
   1. See 3.01 B. above.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system
to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

C. Testing of Pressurized Systems:
   1. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
   2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

D. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
   1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

E. Braze copper tube and fitting socket with BCUP series filler metal without flux. Listed brazing flux to be used for joining of copper tube to brass or bronze fittings and will meet AWS FB3A or FB3C. "Shock" cooling is prohibited. a continuous fillet is to be visible around the completed joint. After cooling, flux residue to be thoroughly removed with warm water and a brush prior to testing. Do not use BCUP filler on copper alloys containing over 10 percent nickel. Piping is to be capped or plugged during construction to prevent entry of foreign material.

F. Welders performing work under this Contract to be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB) or by other approved test procedures using methodology and procedures covered in the ASME Boiler and Pressure Vessel Code, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators". Installation to conform to ANSI 31.1 "Power Piping".
   1. Submit for approval the names, identification, and welder's assigned number, letter or symbol for welders assigned to this project.
   2. The assigned identification symbol to be used to identify the work of each welder and to be indelibly stamped immediately upon completion of each weld.
   3. Welders to be tested and certified for all positions.
   4. Submit identifying stenciled test coupons made by each operator.
   5. Welders may be required to retake welding certification tests without additional expense.
   6. When so requested, a welder will not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.
   7. Recertification of the welder to be made after the welder has taken and passed the required tests.

G. Weld pipe joints in accordance with recognized industry practice and as follows:
   1. Weld pipe joints only when ambient temperature is above 0F.
   2. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
   3. Use pipe clamps or tack-weld joints with 1-inch long welds, 4 welds for pipe sizes to 10-inches, 8 welds for pipe sizes 12-inches to 20-inches.
4. Build up welds with a stringer-bead pass, followed by a hot pass, followed by a cover or filler pass. Eliminate valleys at center and at edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes, and non-metallic inclusions.

5. Do not weld out piping system imperfections by tack-welding procedures. Re-fabricate to comply with requirements.

6. At Installer's option, install forged branch-connection fittings whenever branch pipe is indicated, or install a regular T-fitting.

H. Sanitary and Storm Drainage:
   1. Piping to be graded at a uniform pitch of 2 percent unless otherwise noted on Drawings.
   2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on direct waste or drain piping exceeding 60-inches.
   3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00.
   4. Drains:
      a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Arrange for flooring to be sloped to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
      b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
   5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
   6. Heat trace and insulate P-traps exposed to freezing conditions. Provide heat trace and electronic components to Division 26 for installation.
   7. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.

3.5 WATER PIPING, BURIED WITHIN 5- FEET OF BUILDING

A. Excavation and Backfill:
   1. See 3.01 B. above.

B. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.

C. Domestic Water:
   1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
   2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
   3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
   4. Piping connections to equipment to be made up with unions.
   5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
6. Use reducers or increasers. Use no bushings.
7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
9. Exposed connections to equipment to be installed with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping to be permitted.
10. Ferrous to non-ferrous connections to be made by means of dielectric fittings.
11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
12. Through-Wall Pipes: Type ‘L’ copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.
13. Provide drain valves at base of risers and at low points on the system.

D. Sterilization of Domestic Water System:
1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, refill and return system to service.
4. Provide water line disinfections performed by a D1 Water Operator licensed in the State of California.

E. Buried Preinsulated Pipe Installation:
1. Installation and Testing: Install and test products in accordance with manufacturer’s installation instructions.
2. Manufacturer’s installation instructions shall describe the following:
   a. Storage and handling of pipes.
   b. Trench preparation.
   c. Installing pipe.
   d. Installing accessories.
   e. Installing fittings.
   f. Building penetrations.
   g. Field insulation kits.
   h. Testing.

3.6 HOT AND COLD DOMESTIC WATER ABOVE GRADE

A. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
B. Testing of Pressurized Systems:
   1. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
   2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

C. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

D. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
   1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

E. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Joints to be cleaned by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meets CDA standard test method 1.0 and ASTM B813-91. Solder to be applied until a full fillet is present around the joint. Solder and flux not to be applied in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.

F. Braze copper tube and fitting socket with BCUP series filler metal without flux. Listed brazing flux to be used for joining of copper tube to brass or bronze fittings and will meet AWS FB3A or FB3C. "Shock" cooling is prohibited. a continuous fillet is to be visible around the completed joint. After cooling, flux residue to be thoroughly removed with warm water and a brush prior to testing. Do not use BCUP filler on copper alloys containing over 10 percent nickel. Piping is to be capped or plugged during construction to prevent entry of foreign material.

G. Domestic Water:
   1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
   2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
   3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
   4. Piping connections to equipment to be made up with unions.
   5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
   6. Use reducers or increasers. Use no bushings.
   7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
   8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
   9. Exposed connections to equipment to be installed with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping to be permitted.
10. Ferrous to non-ferrous connections to be made by means of dielectric fittings.
11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.
13. Provide drain valves at base of risers and at low points on the system.

H. Sterilization of Domestic Water System:
   1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
   2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, refill and return system to service.
   4. Provide water line disinfections performed by a D1 Water Operator licensed in the State of California.

3.7 CONDENSATE PIPING

A. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
   1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

3.8 PRIMER PIPING

A. Excavation and Backfill:
   1. See 3.01 B. above.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

3.9 PIPING SPECIALTIES

A. Excavation and Backfill:
   1. See 3.01 B. above.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size
within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

3.10 CLEANOUTS

A. Install in aboveground piping and building drain piping as indicated, as required by code; at each change in direction of piping greater than 135 degrees; at minimum intervals of 100-feet; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish. Provide shop drawings to Architect to coordinate locations and types of cleanouts with Architect prior to installation.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

C. Corrosive Soil Conditions:
   1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.
   2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

END OF SECTION
SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY
A. Work Included:
   1. Commercial Light Duty Electric Storage Type Water Heaters
   2. Domestic Expansion Tanks Non-ASME
   3. Domestic Circulation Pump
   4. Grease Interceptors
   5. Exterior Grease Interceptor - Large Capacity

1.2 RELATED SECTIONS
A. Contents of Division 22, Plumbing apply to this Section.

1.3 REFERENCES AND STANDARDS
A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and
Section 01410, Regulatory Requirements.

1.4 SUBMITTALS
A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330,
Submittal Procedures.

B. In addition, provide:
   1. Seismic anchor details and calculations signed and stamped by licensed California
      structural engineer with equipment data.

1.5 QUALITY ASSURANCE
A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section
01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. NSF 61, Annex G compliant.
   2. ISO 9001 Certified.
   3. IAPMO Low Lead Certification

C. Products approved for installation by state authorizing agency, no exceptions.

1.6 WARRANTY
A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic
Requirements and Section 01740, Warranties/Guaranties.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Commercial Light Duty Electric Storage Type Water Heaters:
   1. Hubbell Series E
   2. A.O. Smith
   3. Bradford White
   4. Bock
   5. State
   6. Or equal.

B. Domestic Expansion Tanks Non-ASME:
   1. Bell and Gossett Series PT
   2. American Wheatley
   3. Amtrol
   4. Armstrong
   5. Watts
   6. Or equal.

C. Domestic Circulation Pumps:
   1. Bell and Gossett Series PL
   2. Armstrong
   3. Grundfos
   4. Paco
   5. Taco
   6. Or equal.

D. Grease Interceptors:
   1. Zurn Series 1171-1170
   2. Thermaco
   3. Rockford
   4. Highland
   5. Smith
   6. Josam
   7. Wade
   8. Watts
   9. Or equal.

E. Exterior Grease Interceptor - Large Capacity:
   1. Pre-fabricated Concrete Unit:
      a. Jensen
      b. Old Castle
      c. Or equal.

2.2 GENERAL

A. Reference drawings for capacities and specific model numbers.
2.3 COMMERCIAL LIGHT DUTY ELECTRIC STORAGE TYPE WATER HEATERS

A. System: Domestic Hot Water

B. Entire unit is to be delivered complete with operating controls and require only plumbing and electrical service connections.

C. Tank welded steel commercial construction designed for 150 PSI. Tank is to be lined with seamless Hydrastone cement to minimum thickness of 1/2-inch on 100 percent of interior tank surfaces, and not require any type of anodic protection. Tank designed and fabricated with non-ferrous copper-silicon threaded tapings and non-ferrous inlet and outlet piping for maximum corrosion resistance. Steel tank tappings will not be acceptable. Entire tank is to be insulated with minimum of 2-inches thick polyurethane foam insulation and exceed latest ASHRAE standard for stand-by heat loss. Complete heater supplied with high impact colorized composite protective jacket which cannot rust or corrode and does not require painting.

D. Cold water inlet 3/4-inch Female NPT (1-1/2-inch Male NPT) and include non-corrosive strata-flow diffuser which prevents incoming cold water from mixing too rapidly with hot water in tank. 3/4-inch hose connection drain is supplied. Hot water outlet 3/4-inch Male NPT (1-1/2-inch Male NPT) and includes factory installed built-in heat trap to prevent water from radiating through piping during stand-by periods. Separate 3/4-inch Female NPT tapping is to be provided for relief valve installation. An ASME rated automatic reseating combination temperature and pressure safety relief valve set at 150 PSI and 210 degrees F factory supplied.

2.4 DOMESTIC EXPANSION TANKS NON-ASME

A. Welded steel, constructed, tested and stamped in accordance with IAPMO Standards for working pressure of 125 PSI. Support floor mounted tanks with steel legs or base. Provide single flexible diaphragm securely sealed into tank to separate air charge from system water, to maintain design expansion capacity. Provide pressure gauge and air-charging fitting, and drain fitting. Diaphragm: Removable and replaceable in line.

2.5 DOMESTIC CIRCULATION PUMPS

A. System: Domestic water.

B. Provide in-line factory tested pumps, cleaned, and painted with enamel prior to shipment. Pumps to be rated for domestic water. Provide pumps of same type by same manufacturer.

C. Type: Horizontal, oil-lubricated, designed for 150 PSI working pressure, 225 F continuous water temperature.

D. Body: Bronze or Stainless steel construction.

E. Shaft: Stainless or Carbon steel, ground and polished, integral thrust collar.

F. Bearings: Two horizontal sleeve sealed steel bearings permanently lubricated designed to circulate oil.

G. Seal: Mechanical, with carbon seal face rotating against ceramic seat.
H. Face plate: Stainless steel.

I. Motor: Nonoverloading at any point on pump curve, open, drip-proof, sleeve bearings, quiet operating, rubber mounted construction, built-in thermal overload protection.

J. Elastomers: EPDM.

K. Provide Honeywell 115 volt immersion aquastat set at 115 or 118 degrees F.

L. Option. Pump may be operated from Building Automation System. Coordinate installation of additional devices with controls contractor.

2.6 GREASE INTERCEPTORS

A. Interior and exterior acid resistant coated, steel or stainless steel, grease interceptor, gasketed nonskid locking cover. Cascade bottom. Internal air relief, visible double wall trap, removable baffles. Clamping ring and anchor flange. Grease draw-off piping, flexible hose and valve Zurn Z1108/Z1108-L remote in line, flow control fitting. Provide extension where required by structural features or depth of piping.

B. Interceptor installed flush with finish floor unless specifically directed otherwise by Architect or as detailed on Drawings.

2.7 EXTERIOR GREASE INTERCEPTOR - LARGE CAPACITY

A. Prefabricated Concrete Unit:
   1. Prefabricated reinforced concrete with H-20 traffic load with minimum of 2-feet of soil cover, two compartment, two concrete access risers with 24-inches diameter gas and water tight manhole covers, 4-inch inlet and 4-inch outlet. Unit set on level compacted or undisturbed soil.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Orient so controls and devices needing service and maintenance have adequate access.

D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

E. Connect water piping to units with shutoff valves and unions.
F. Equipment Rigging: Heavy duty rigging eye bolts for Crosby Group swivel hoist rings installed over pump access covers for removal or maintenance.

G. Equipment Start-Up:
   1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
   2. Start-up performed by authorized manufacturer's representative or agent. Provide credentials of start-up personnel to Architect and Owner's Representative for approval.
   3. Remove and replace filters when start-up testing is executed.
   4. Manufacturer adjusts operating parameters of equipment to compensate to elevation of 500-feet above sea level.
   5. Architect, Commissioning Agent, and Owner's Representative will be notified 10 days prior to start-up and will be present at start-ups.
   6. Provide written report from manufacturer's representative on results of start-up within 48 hours.
   7. Technical Training of maintenance staff includes two hours minimum per each piece of equipment.
   8. Seismic Verification:
      a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
      b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

3.2 COMMERCIAL LIGHT DUTY ELECTRIC STORAGE TYPE WATER HEATERS

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Orients so controls and devices needing service and maintenance have adequate access.

D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

E. Connect water piping to units with shutoff valves and unions.

3.3 DOMESTIC EXPANSION TANKS NON-ASME

A. Precharge tank per manufacturers recommendation.

B. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
C. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

D. Orients so controls and devices needing service and maintenance have adequate access.

E. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

F. Connect water piping to units with shutoff valves and unions.

3.4 DOMESTIC CIRCULATION PUMPS

A. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Orients so controls and devices needing service and maintenance have adequate access.

C. Connect water piping to units with shutoff valves and unions.

D. Provide lift check valves 5 diameters downstream of pump discharge for circulating pumps piped in a parallel configuration.

E. Equipment Start-Up:
   1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
   2. Architect, Commissioning Agent, and Owner's Representative will be notified 10 days prior to start-up and will be present at start-ups.
   3. Seismic Verification:
      a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
      b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

3.5 GREASE INTERCEPTORS

A. Provide and install per local ordinances/FOG programs and manufacturer's recommendations.

3.6 EXTERIOR GREASE INTERCEPTOR - LARGE CAPACITY

A. Provide and install per local ordinances/FOG programs and manufacturer's recommendations.

END OF SECTION
SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. General Plumbing Fixtures:
      a. China Fixtures, White Only
      b. Faucet Fittings
      c. Fiberglass Fixtures, White Only
      d. Hose Reels
      e. Molded Resin or Stone Fixtures
      f. Stainless Steel Fixtures
      g. Thermostatic Mixing Valves
      h. Trench Drains
   2. Carriers
   3. Drinking Fountains
   4. Electric Water Coolers
   5. Emergency Showers/Eyewash
   6. Fixture Trim
   7. Floor Drains
   8. Floor Sinks
   9. Flushometers - Water Closet/Urinal
   10. Hose Bibbs
   11. Hub Drains
   12. Water Closet Seats
   13. Water Supply Boxes

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
1. Comply with lead free (less than or equal to 0.25 percent) products in drinking water systems.
4. IAPMO Low Lead Certification.
5. Provide fixtures, faucets and accessories to meet barrier free requirements of the governing code with respect to plumbing fixtures provided for the physically handicapped.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. "Or equal" as defined in 22 00 00, General Plumbing Requirements. Substitution process requirements apply to equal products.

B. General Plumbing Fixtures: See Schedule on Drawings for type.
1. China Fixtures - White Only:
   a. American Standard
   b. Briggs
   c. Crane
   d. Eljer
   e. Kohler
   f. Or equal.
2. Faucet Fittings:
   a. Private:
      1) Chicago
      2) Delta Commercial
      3) Moen
      4) Speakman
      5) Symmons
      6) T&S Brass
      7) Or equal.
   b. Public:
      1) American Standard
      2) Chicago
      3) Delta Commercial
      4) Moen Commercial
      5) Sloan
      6) Symmons
      7) T & S Brass
      8) Or equal.
3. Fiberglass Fixtures - White Only:
   a. Aqua-Glass
b. Briggs  
c. Crane  
d. Comfort Designs  
e. Hytec  
f. Mustee  
g. Universal-Rundle  
h. Or equal.

4. Hose Reels:  
a. Balcrank  
b. Lincoln  
c. Or equal.

5. Molded Resin or Stone Fixtures:  
a. Fiat  
b. Mustee  
c. Stern Williams  
d. Or equal.

6. Stainless Steel Fixtures:  
a. Elkay  
b. Haws  
c. Just  
d. Or equal.

7. Thermostatic Mixing Valves:  
a. Bradley  
b. Powers  
c. Symmons  
d. Holby  
e. Or equal.

8. Trench Drains:  
a. Channel-Slope  
b. JR Smith  
c. PolyDrain  
d. Polycast  
e. Quazite  
f. Zurn  
g. Or equal.

C. Carriers:  
1. JR Smith  
2. Zurn  
3. Or equal.

D. Drinking Fountain:  
1. Elkay  
2. Halsey-Taylor  
3. Haws  
4. Oasis  
5. Sunroc  
6. Or equal.
E. Electric Water Coolers:
   1. Elkay
   2. Halsey-Taylor
   3. Haws
   4. Oasis
   5. Sunroc
   6. Or equal.

F. Emergency Showers/Eyewash:
   1. Bradley
   2. Encon
   3. Guardian
   4. Haws
   5. Speakman
   6. Or equal.

G. Fixture Trim:
   1. McGuire
   2. Dearborn Brass
   3. Oatey
   4. Or equal.

H. Floor Drains:
   1. Mifab
   2. Sioux Chief
   3. Smith
   4. Wade
   5. Watts
   6. Zurn

I. Floor Sinks:
   1. Commercial Enameling
   2. Mifab
   3. Sioux Chief
   4. Smith
   5. Wade
   6. Watts
   7. Zurn
   8. Or equal.

J. Flushometers - Water Closet/Urinal:
   1. Sloan
   2. Zurn
   3. Or equal.

K. Hose Bibbs:
   1. Chicago
   2. JR Smith
   3. Mifab
4. Wade
5. Woodford
6. Zurn
7. Or equal.

L. Hub Drains:
   1. JR Smith
   2. Zurn
   3. Or equal.

M. Water Closet Seats:
   1. Bemis
   2. Or equal.

N. Water Supply Boxes:
   1. Sioux Chief
   2. Or equal.

2.2 GENERAL PLUMBING FIXTURES

A. Review substitution request requirements in Section 00700, General Conditions, and 22 00 00, Plumbing General Requirements.

B. Reference Architectural Details for mounting height and location of fixtures.

C. Provide factory fabricated fixtures of type, style and material indicated on the plumbing fixture connection schedule shown on the Drawings. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, or required for complete installation. Where more than one type is indicated, selection is installer's option; but, fixtures of same type must be furnished by a single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

D. Provide fixtures complete with fittings, supports, fastening devices, bolt caps, faucets, valves, traps, stops and appurtenances.

E. Plumbing Fixture Flow Rates:
   1. Water Closets: Single flush at 1.28 GPF.
   2. Lavatories in public core areas to be set for a maximum of 0.5 GPM flow. Other lavatories to be 1.0 GPM flow.
   3. Sinks to be set for a maximum of 1.5 GPM flow.
   4. Showers factory set at a maximum of 1.8 - 2 GPM flow.

F. Plumbing Fixture Thermostatic Mixing Valves:
   1. Lavatories provide ASSE 1070 compliant mixing valves or multiple lavatories served by a single ASSE 1070 compliant mixing valve.
   2. Sinks serviced with a single ASSE 1070 mixing valve or multiple sinks served by a single ASSE 1070 mixing valve.
   3. Commercial kitchen handsinks provide ASSE 1070 mixing valves.
4. Janitor sinks or process/maintenance type sinks do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.
5. Hot water hose bibbs do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

2.3 CARRIERS

A. Wall Hung Water Closets:

B. Wall Hung Urinal: Zurn Z-1218-WS. (JR Smith 913). Coupling type or plate type with bearing plate 300 lb. capacity.

C. Wall Hung Lavatory: Zurn Z-1231 (D). (JR Smith 700). Concealed arm, 250 lb. capacity.


E. Wall Hung Drinking Fountain: Z-1225-BL (JR Smith 834-97-98). Plate type.

F. 750 lb. Carrier for Water Closet:
   1. Adjustable vertical type.
   2. Adjustable horizontal type.

2.4 DRINKING FOUNTAINS

A. See Schedule on Drawings for type.

2.5 ELECTRIC WATER COOLERS

A. See Schedule on Drawings for Type.

2.6 EMERGENCY SHOWERS/EYEWASH

A. Provide emergency showers/eyewash products that are compliant with ANSI Z358.1, Standards for Emergency Eyewashes and Shower Equipment.

2.7 FIXTURE TRIM

A. Traps: Provide heavy duty commercial grade traps on fixtures except fixtures with integral traps. Exposed traps will be chromium plated cast brass or 17 gauge chromium plated brass tubing.
   1. Sink: McGuire 8912-C-DF.
   2. Lavatory: McGuire 8902-C-DF.
B. Supplies and Stops: Lead free heavy duty commercial grade, chrome plated with brass stems.
   Stops: T-handle or Loose Key type.
   1. Lavatory: McGuire LFH 2165 CK
   2. Sink: McGuire LFH 2167 LK
   3. Water Closets: McGuire

C. Lavatory Grid Strainer: McGuire 155A.

D. Sink Grid Strainer: McGuire 152N.


F. Sink Basket Strainer: McGuire 151.

G. Trim barrier-free wrap for P-traps and supplies by McGuire, Pro-Wrap, Plumberex or True-bro.

H. Escutcheons: McGuire wrought brass deep bell.

I. Wax Rings and Toilet Bolts: WM Harvey No Seep No. 1 053065-N.

2.8 FLOOR DRAINS
   A. See Schedule on Drawings for types.

2.9 FLOOR SINKS
   A. See Schedule on Drawings for types.
   B. Plastic components are not allowed.

2.10 FLUSHOMETERS - WATER CLOSET/URINAL
   A. See Schedule on Drawings for types.

2.11 HOSE BIBBS
   A. See Schedule on Drawings for types.

2.12 HUB DRAINS
   A. See Schedule on Drawings for type.

2.13 WATER CLOSET SEATS
   A. See Schedule on Drawings for type.

2.14 WATER SUPPLY BOXES
   A. See Schedule on Drawings for Type.
B. Provide fire rated ASTM E-84 rated boxes where required by building construction.

PART 3 - EXECUTION

3.1 GENERAL PLUMBING FIXTURE INSTALLATION INFORMATION

A. Verification of Conditions:
1. Examine rough-in work of water supply and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures.
2. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.
3. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings and pertinent codes and regulations, design and referenced standards.
4. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
5. Install a stop valve in a readily accessible location in water connection to each fixture.
6. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Seal fixtures to walls and floors using silicone sealant Dow Corning No. 780 or equal. Match sealant color to fixture color.
8. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
9. Inspect each unit for damage prior to installation. Replace damaged fixtures.
10. Replace washers or cartridges of leaking or dripping faucets and stops.
11. Clean fixtures, trim and strainers using manufacturer's recommended cleaning methods and materials.
12. During construction, cover installed fixtures, drains, sinks and water coolers with cardboard and wrap with sheet plastic.
13. Provide trap primers for floor drains, floor sinks, trench drains and hub drains.
14. Install roof and overflow roof drains per architectural details. Cover drains during roof construction to protect drain. Provide offsets or expansion joints at each roof/overflow drain.
15. Do not use lead flashing.

B. Owner Furnished Equipment:
1. Rough-in and make final connections to Owner furnished equipment. Provide necessary items to complete installation.
2. Comply with requirements of this Section and Drawings for installation procedures.

C. Adjusting and Cleaning: Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation. Adjust water pressure at drinking fountains, faucets, shower valves and flush valves to provide proper flow stream and specified GPM. Repair leaks at faucets and stops.
D. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner.

E. Field Quality Control: Upon completion of installation of plumbing fixtures, test fixtures to demonstrate capability and compliance with Specifications. Correct or replace malfunctioning units at site, then retest to demonstrate compliance.

F. Protection: Protect fixtures and equipment from damage. Cover finished fixtures with cardboard and sheet plastic. Fixtures are not to be used during construction. Replace damaged items with new.

G. Signage: For fixtures that do not have ASSE 1070 mixing valve protection for hot water temperature, provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.2 CARRIERS INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

C. Coordinate wall thickness so carrier has adequate depth to be concealed.

3.3 DRINKING FOUNTAIN INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.4 ELECTRIC WATER COOLER INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.5 EMERGENCY SHOWERS/EYEWASH INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.6 FIXTURE TRIM INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.
3.7 FLOOR DRAINS INSTALLATION
A. Install components in accordance with manufacturer's instructions and approved product data submittals.
B. Set plumb, level and rigid.

3.8 FLOOR SINK INSTALLATION
A. Install components in accordance with manufacturer's instructions and approved product data submittals.
B. Set plumb, level and rigid. Set fixture rim/grate flush with surrounding finish surface unless specifically noted otherwise.

3.9 FLUSHOMETERS - WATER CLOSET/URINAL INSTALLATION
A. Install components in accordance with manufacturer's instructions and approved product data submittals.
B. Set plumb, level and rigid. Set fixture rim/grate flush with surrounding finish surface unless specifically noted otherwise.

3.10 HOSE BIBB INSTALLATION
A. Install components in accordance with manufacturer's instructions and approved product data submittals.
B. Set plumb, level and rigid.

3.11 HUB DRAINS INSTALLATION
A. Install components in accordance with manufacturer's instructions and approved product data submittals.
B. Set plumb, level and rigid.

3.12 WATER CLOSET SEAT INSTALLATION
A. Install components in accordance with manufacturer's instructions and approved product data submittals.
B. Set plumb, level and rigid.

3.13 WATER SUPPLY BOX INSTALLATION
A. Install components in accordance with manufacturer's instructions and approved product data submittals.
B. Set plumb, level and rigid.

END OF SECTION
SECTION 23 00 00

HEATING, VENTILATING AND AIR CONDITIONING (HVAC) BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 23 00 00, HVAC Basic Requirements applies to Division 23, HVAC work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of heating, ventilating and air conditioning systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:
   1. Provide: To furnish and install, complete and ready for intended use.
   2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
   3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work provided.
   4. Or Equal: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Section 01330, Submittal Procedures, and approved by the Engineer prior to submitting bids for substituted items.
   5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 23, HVAC Contract Documents.

B. Related Work:
   1. Additional conditions apply to this Division including, but not limited to:
      a. Specifications
      b. Drawings
      c. Addenda
      d. Owner/Architect Agreement
      e. Owner/Contractor Agreement
      f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Section 01410, Regulatory Requirements, individual Division 23, HVAC Sections and those listed in this Section.
B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
   1. State of California:
      a. CBC - California Building Code
      b. CEC - California Electrical Code
      c. CEC T24 - California Energy Code Title 24
      d. CFC - California Fire Code
      e. CMC - California Mechanical Code
      f. CPC - California Plumbing Code
      g. CSFM - California State Fire Marshal
      h. DSA - Division of State Architect Regulations and Requirements

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
   1. ABA - Architectural Barriers Act
   2. ABMA - American Bearing Manufacturers Association
   3. ADA - Americans with Disabilities Act
   4. AHRI - Air-Conditioning Heating & Refrigeration Institute
   5. AMCA - Air Movement and Control Association
   6. ANSI - American National Standards Institute
   7. ASCE - American Society of Civil Engineers
   8. ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers
   9. ASHRAE Guideline 0, The Commissioning Process
   10. ASME - American Society of Mechanical Engineers
   11. ASPE - American Society of Plumbing Engineers
   12. ASSE - American Society of Sanitary Engineering
   13. ASTM - ASTM International
   14. AWWA - American Water Works Association
   15. CFR - Code of Federal Regulations
   16. CISPI - Cast Iron Soil Pipe Institute
   17. EPA - Environmental Protection Agency
   18. ETL - Electrical Testing Laboratories
   19. FM - FM Global
   20. GAMA - Gas Appliance Manufacturers Association
   21. HI - Hydraulic Institute Standards
   22. IAPMO - International Association of Plumbing & Mechanical Officials
   23. IFGC - International Fuel Gas Code
   24. ISO - International Organization for Standardization
   25. MSS - Manufacturers Standardization Society
   26. NEC - National Electric Code
   27. NEMA - National Electrical Manufacturers Association
   28. NFPA - National Fire Protection Association
   29. NFGC - National Fuel Gas Code
   30. NRCA - National Roofing Contractors Association
   31. NSF - National Sanitation Foundation
   32. OSHA - Occupational Safety and Health Administration
   33. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
34. TEMA - Tubular Exchanger Manufacturers Association
35. TIMA - Thermal Insulation Manufactures Association
36. UL - Underwriters Laboratories, Inc.

D. See Division 23, HVAC individual Sections for additional references.

E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

F. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

G. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.4 SUBMITTALS

A. See Section 01330, Submittal Procedures as well as specific individual Division 23, HVAC Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:
   1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
   2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each Specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
   3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 23, HVAC Sections.
   4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 23, HVAC Specification Sections for specific items required in product data submittal outside of these requirements.

c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.

d. For vibration isolation of equipment, list make and model selected with operating load and deflection.

e. See Division 23, HVAC individual Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Structural documents.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required by Division 23, HVAC Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.

9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10. Substitutions and Variation from Basis of Design:
   a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
   b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the
Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or equal", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, equipment, ductwork and piping layout plans, and control wiring diagrams. Reference individual Division 23, HVAC Specification Sections for additional requirements for shop drawings outside of these requirements.
   a. Provide Shop Drawings indicating access panel locations for items that require Code or maintenance access, size and elevation for approval prior to installation.

12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:
   a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
      1) Resubmit for review until review indicates no exception taken or make "corrections as noted".
      2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

14. Operation and Maintenance Manuals, Owners Instructions:
   a. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
      1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
      2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
      3) Include Warranty per Section 01740, Warranties/Guaranties, Section 23 00 00, HVAC Basic Requirements and individual Sections.
      4) Include product certificates of warranties and guarantees.
      5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
      6) Include copy of startup and test reports specific to each piece of equipment.
      7) Include copy of final air and water systems balancing log along with pump, fan and distribution system operating data.
      8) Include commissioning reports.
      9) Include copy of valve charts/schedules.
10) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 23 00 00, HVAC Basic Requirements Article titled "Demonstration".

c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:

a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

b. Record Drawings are to include equipment and fixture/connection schedules, control dampers, fire smoke dampers, fire dampers, valves, bottom of pipe, duct and equipment elevations and dimensioned locations for all distribution systems (hydronic and air). Invert elevations and dimensioned locations for underground systems below grade to 5-feet outside building that accurately reflect "as constructed or installed" for project.

c. At completion of project, input changes to original project CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.

d. See Division 23, HVAC individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State, Federal and other applicable laws and regulations.

B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

E. Provide products that are UL listed.

F. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

G. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Section 01740, Warranties/Guaranties, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Section 01740, Warranties/Guaranties. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Section 01311, Project Management and Coordination, and/or Division 23, HVAC to combine information furnished by other trades onto master coordination documents.

B. Prepare Drawings as follows:
   1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
   2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
   3. Indicate hydronic and air distribution system piping including fittings, hangers, access panels, valves, and bottom of pipe and duct elevations above finished floor.
   4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible items. Drawings also to indicate proposed ceiling grid and lighting layout.
as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork and piping.

5. Incorporate Addenda items and change orders.
6. Distribute drawings to trades and provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide like items from one manufacturer, including but not limited to pumps, fans, valves, control devices, air handlers, vibration isolation devices, etc.

2.2 MATERIALS

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities.

B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

D. Hazardous Materials:
   1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
   2. Comply with Section 01412, Hazardous Materials, for this project relating to hazardous materials.
   3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.
PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A., Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Install equipment having components requiring access (i.e., drain pans, drains, control operators, valves, motors and vibration isolation devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions including all appurtenances recommended in manufacturer's installation instructions, at no additional charge to Owner. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:
   1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
      a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
      b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
      c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:
   1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
      a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:
   1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building, as well as anticipated settlement or
shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, seismic flexible joints, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.

2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:
   1. Plenums: Materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. Immediately notify Architect / Engineer of any discrepancy.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Structural documents, Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment, and individual Division 23 HVAC Sections.

B. General:
   1. Earthquake resistant designs for HVAC (Division 23) equipment and distribution, i.e. motors, ductwork, piping, equipment, etc. to conform to regulations of jurisdiction having authority.
   2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
   3. Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for piping equipment and water heaters. Submit Shop Drawings along with equipment submittals.
   4. Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

C. Piping and Ductwork:

D. Provide means to prohibit excessive motion of mechanical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Section 01400, Quality Control Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
1. Underground system installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. After major equipment is installed.
5. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:
1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Mechanical Precloseout Checklist, complete the checklist confirming completion of systems’ installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer’s acceptance that the mechanical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Comply with individual Division 23, HVAC Sections and the following:
1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping and ductwork, and wiring to point of connection. Where existing systems are being utilized, clean existing distribution systems (ductwork, piping, fans, air handlers) prior to connecting new ductwork or piping.
3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
   a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Section 01730, Cutting and Patching, and individual Division 23, HVAC Sections and the following:
1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

B. Maintain design intent where equipment other than as shown as Basis of Design in Contract Documents is provided. Where equipment requires ductwork or piping arrangement, controls/control diagrams, or sequencing different from that indicated in Contract Documents, provide at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Section 00700, General Conditions. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
   1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage to be replaced before installation.
   2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
   3. Protect bright finished shafts, bearing housings and similar items until in service.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Section 01770, Contract Closeout Procedures, Articles 1.12, 1.13, and 1.14, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Section 01770, Contract Closeout Procedures, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

A. Confirm Cleaning requirements in Section 01710, Cleaning Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

A. Confirm Installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
   1. Do not place equipment in sustained operation prior to initial balancing of HVAC systems.

D. Provide miscellaneous supports/metals required for installation of equipment, piping and ductwork.

3.11 PAINTING

A. Confirm Painting requirements in Division 09, Finishes. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
   1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
   2. After acceptance by Authority Having Jurisdiction (AHJ), In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
   3. See individual equipment Specifications for other painting.
   4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Piping and Ductwork: Clean, primer coat and paint exposed piping and ductwork on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

A. Confirm requirements in Section 01770, Contract Closeout Procedures. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
   1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
      a. Testing and Balancing Reports
      b. Cleaning
      c. Operation and Maintenance Manuals
      d. Training of Operating Personnel
      e. Record Drawings
      f. Warranty and Guaranty Certificates
      g. Start-up/Test Document
      h. Commissioning Reports

3.13 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Tests:
   1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.
   2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that HVAC items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.
3.16 TEMPORARY HEATING, COOLING AND HUMIDITY CONTROL

A. Provide temporary heating, cooling, controls, humidification and dehumidification as required to facilitate the construction of the project. Size and select temporary system based on the requirements of the various trades during construction. This includes, but is not limited to, drywall, case work, wood flooring and wood finishes that are subject to warping. Size and install system to prevent mold growth. Coordinate the location of the temporary system. The house system can be used. Develop a procedure for how the house system will be used including a sketch depicting the house system, how filtration will be used to prevent construction debris from entering the system and how often the filters will be changed, how the ductwork will be cleaned after use to ensure a clean system is turned over to the Owner and how the units are sized. Submit this procedure to the Mechanical Engineer for review. Follow National Air Duct Cleaners Association (NADCA) duct cleaning procedures and guidelines. Warranties for the house system, if new, to commence when the Owner moves in if house system is used as the means to maintain the climate within the building during construction. Include this warranty requirement in the original bid or proposal amount. Coordinate and provide any temporary power, controls, ductwork, piping, plumbing anchorage, miscellaneous steel and structural supports required to support the temporary system. Installation of the system to comply with all applicable codes and be acceptable to the Authority Having Jurisdiction (AHJ).

END OF SECTION
SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Starters
   2. Shaft Grounding
   3. Motors

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. NEMA Premium Efficiency
   2. Energy Policy Act (EPACT), latest applicable version(s) for minimum motor efficiencies.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Field Installed Motors: Installed motors to be of single type, from one source and from a single manufacturer.
   2. Electrical components and materials to be UL and ETL listed/labeled as suitable for location and use.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

B. In addition, provide:
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Starters:
   1. Cerus
   2. Eaton Electrical
   3. General Electric
   4. Siemens
   5. Schneider Electric/Square D
   6. Or equal.

B. Shaft Grounding:
   1. Shaft Grounding Inc.
   2. Aegis SGR Bearing Protection Ring
   3. Or equal.

C. Motors:
   1. Lincoln Motor
   2. Century Electric Motors (formerly A.O. Smith Electrical Products)
   3. Baldor Electric
   4. General Electric
   5. Toshiba
   6. Exception: Motors integral to equipment efficiency listing (EER, COP, etc.) per listing agency.
   7. Or equal.

2.2 STARTERS

A. Single Phase Motors:
   1. Manual across-the-line starting switch having toggle-operated switch pilot running light and built-in thermal overload device with heating element rated not more than 115 percent motor full load current indicated on name plate of motor to be protected. Surface mount starters. Provide NEMA-1 enclosure.
   2. Overload relays to be melting alloy type with a replaceable control circuit module. Thermal units to be interchangeable. Starter to be non operative if thermal unit is removed.

B. Starters up to Size 8 to be suitable for the addition of a minimum of three external auxiliary contacts (normally open or normally closed). Contactor, coils, and relays to perform the control functions of the associated equipment and control sequence.

C. Three Phase Motors up to and Including 15 HP:
1. Provide enclosed type magnetic across-the-line starter with thermal overload and undervoltage protection.

2. Operator: "Start-Stop" pushbutton, except where automatic control is indicated on Drawings or specified. Then provide "Hand-Off-Auto" selector switch.

3. Starters for 3-phase motors to have overload protection in each of the three legs, with external manual reset.

4. Unless indicated on Drawings or in Specifications, furnish motor starters with a neon pilot light. Neon lights are required for exhaust fan switches.

5. Equip starters with integral transformer and coil for control circuit. Coordinate coil voltage with control voltage.

D. For Three Phase Motors Greater than 15 HP:

   1. Provide combination starter and fused safety disconnect integral in the same enclosure. Utilize Type 'RK' or 'L' fuses. Provide fuse block with rejection type fuse holders. Size fuses per motor manufacturer's recommendations.

   2. Provide a solid-state reduced voltage starter, consisting of power section, one-piece removable printed circuit logic board and field wiring interface terminals. Logic board uses quick disconnect plug-in connectors for current transformers inputs, line-and-load voltage inputs, SCR gate firing output circuits and status panel. 3-phase current sensing via current transformers. Class 10 electronic overload protection.

   3. Motor starters to include the following protections:

      a. Inverse time running overcurrent protection.

      b. 250 percent to 500 percent current limit adjustment.

      c. Minimum and maximum voltage adjustments.

      d. Voltage stability adjustment.

      e. Single-phase protection with built-in short-time delay.

      f. Undervoltage protection with built-in short time delay.

      g. MOV surge suppression protection of SCRs rated 10 percent above the rated voltage.

      h. Phase sequence protection.

   4. Display: Door-mounted status LCD alphanumeric or LED display indicating run, undervoltage, phase loss, phase current unbalance, overcurrent trip, overtemperature, current limit, end of ramp, and incorrect phase rotation.

   5. Enclosure: NEMA 12. Operator: "Start-Stop" pushbutton, except where automatic control is indicated on Drawings or specified, then provide "Hand-Off-Auto" selector switch.

   6. Input/Output Relays: Provide relays as required to provide the control sequence.

   7. UL 508 listed.

2.3 SHAFT GROUNDING

A. Variable Speed Motor Shaft Grounding: Shaft grounding ring; solid ring type.

B. Provide shaft grounding assembly on motors controlled by variable frequency drive. Shaft grounding device to be in the form of brush that resides on the motor shaft. Brush assembly shall be capable of tolerating misalignment and maintaining rotating contact throughout the motors life.
C. Material: Material used in the grounding assembly shall be stable material commonly used within industry that is not believed to constitute a hazardous material under Occupational Safety & Health Administration (OSHA) regulations.

D. Brushes: Specifically developed carbon compounds of sustained performance with wear life expectancy of 3 years minimum.

E. Seals: Sealed type to keep contaminants from entering the shaft grounding system in wet or severe environment applications.

F. Shaft Grounding Assembly: For clean room air handling systems, use the type that contains the wear products within a special enclosure within the shaft grounding system.

2.4 MOTORS

A. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   4. Built-in thermal overload protection or externally protected with separate over-load with low-voltage release or lock-out. Quick trip device on hermetically sealed motors.
   5. Service Factor: 1.15 for poly-phase motors except 1.25 for motors associated with shaft pressurization system fans and 1.35 for single phase motors.
   7. Motors used in conjunction with variable speed drives: Variable torque type matched for the full operating range of the variable frequency drive. As a minimum, motors to have Class F insulation, winding insulation rated for 1000 Volts and insulated bearings to prevent high frequency ground path. Loads not-to-exceed 80 percent of nameplate rating

B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Coordinate conductor sizes with Division 26, Electrical. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

D. Single Phase Power, Split Phase Motors:
   1. Starting Torque: Less than 150 percent of full load torque.
   2. Starting Current: Up to seven times full load current.
   4. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
5. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

E. Single Phase Power, Permanent-Split Capacitor Motors:
1. Starting Torque: Exceeding one fourth of full load torque.
2. Starting Current: Up to six times full load current.
3. Multiple Speed: Through tapped windings.
4. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

F. Single Phase Power, Capacitor Start Motors:
1. Starting Torque: Three times full load torque.
2. Starting Current: Less than five times full load current.
3. Pull-up Torque: Up to 350 percent of full load torque.
5. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
6. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.
7. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

G. Three Phase Power, Squirrel Cage Motors:
1. Starting Torque: Between 1 and 1-1/2 times full load torque.
2. Starting Current: Six times full load current.
3. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
5. Insulation System: NEMA Class B or better. Use class F insulation when motors are controlled by a VFD.
6. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
7. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
8. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter.
9. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
10. Sound Power Levels: To NEMA MG 1.
11. Weatherproof Epoxy Treated Motors: Epoxy coat windings with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
12. Nominal Efficiency: Meet or exceed NEMA Premium Efficiency rating when tested in accordance with IEEE 112.
13. Nominal Power Factor: Minimum at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Coordinate location of disconnect and starter or motor controller. Combination starter/disconnects may be used in lieu of separate items.
B. Explosion-Proof Motors: UL approved and labeled for hazard classification, with over temperature protection.
C. Provide inverter ready motors per NEMA MG1-30 for variable speed drive or soft-start starter use. Provide shaft grounding for motors over 2 HP serving variable speed drives. Provide shaft grounding and insulated bearings on motors 25 HP and larger serving variable speed drives. Shielded cable required for power wiring from variable speed drive to motor connection.
D. Unless otherwise indicated, motors 1-HP and larger to meet/exceed NEMA Premium Efficiency and latest EPACT.
E. Vertical in-line pump motors per NEMA MG1 vertical motor requirements.
F. Exception: Motors less than 250 watts, for intermittent service, motors furnished with equipment manufacturer's standard package equipment need not conform to these specifications.
G. Single phase motors for air compressors and pumps: Capacitor start type.
H. Motors located in exterior locations or wet air streams are to be of totally enclosed type.
I. Motors located wet/wash-down locations: Totally enclosed weatherproof epoxy-sealed type.
J. Disconnects: Provided by Division 26, Electrical unless specified otherwise.
K. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

3.2 STARTER INSTALLATION

A. Install starters in accordance with manufacturer's instructions.
B. Coordinate disconnect requirements and location with Division 26, Electrical if not integral to starter. If starter is installed out of line of sight of motor, provide additional disconnect at motor per code.
C. Provide NEMA housing appropriate to installation location.
D. Provide supports and install securely, in neat and workmanlike manner, as specified in NECA 1.

E. Meet mounting height and accessible location requirements per local code.

F. Provide fuses for fusible switches.

G. Select and install overload heater elements in motor starters to match installed motor characteristics.

H. Single phase 120 Volt starter: if not furnished as single packaged controller/disconnect, provide contactors, relays, wiring and devices necessary to match sequence of operation for equipment.

### 3.3 SHAFT GROUNDING INSTALLATION

A. Shaft grounding assembly installation not to affect the motor manufacturer warranty. Where the severe environment conditions require application of the shaft grounding types that are screwed into the motor shaft, the installation of the shaft grounding system performed either by the motor manufacturer or by the motor manufacturer authorized facility.

B. Bond the brush to the closest ground point using code sized green insulated stranded copper conductor per manufacturer instructions.

C. Test and verify the performance of the assembly to ensure that under no conditions the shaft exceeds 3 volts.

D. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

E. Check line voltage and phase and ensure agreement with nameplate.

F. Verify motor rotation.

### 3.4 MOTOR INSTALLATION

A. Electrical Service: Power wiring from source to motor termination under Division 26, Electrical.

B. Install in accordance with manufacturer's instructions. Coordinate with starter or variable speed controller with control sequence to provide necessary starter accessories.

C. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

D. Check line voltage and phase and ensure agreement with nameplate.

E. Verify motor rotation.

F. Field Quality Control:
   1. Prepare for acceptance tests as follows:
a. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
b. Test interlocks and control features for proper operation.
c. Verify that current in each phase is within nameplate rating.

2. Testing: Perform the following field quality-control testing:
   a. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
   b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
   a. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
   b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   c. Verify bearing lubrication.
   d. Verify proper motor rotation.
   e. Test Reports: Prepare a written report to record the following test procedures used:
      1) Test results that comply with requirements.
      2) Test results that do not comply with requirements and corrective action taken to achieve compliance.

G. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

H. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION
SECTION 23 05 19
METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Pressure Gauges
   2. Thermometers
   3. Dial Thermometers
   4. Separable Sockets
   5. Thermometer Wells
   6. Duct Thermometer Support Flanges
   7. Differential and Filter Pressure Gauges
   8. Pressure-Gauge Fittings
   9. Test Plugs
   10. Thermal Energy Flowmeters

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Maintenance Materials:
      a. Extra gauge Oil for Inclined Manometers: One Bottle
      b. Extra Pressure Gauges: One

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pressure Gauges:
   1. Trerice Model 600CB.
   2. Dwyer Instruments, Inc.
   3. Moeller Instrument Co., Inc.
   4. Omega Engineering, Inc.
   5. Or equal.

B. Thermometers:
   1. Trerice Model BX9.
   2. Ashcroft
   3. Weiss
   4. Marshaltown
   5. Weksler
   6. Or equal.

C. Dial Thermometers:
   1. Trerice Model 80742.
   2. Ashcroft
   3. Weiss
   4. Marshaltown
   5. Weksler
   6. Or equal.

D. Separable Sockets:
   1. Kimray
   2. Weiss
   3. Trerice
   4. Or equal.

E. Thermometer Wells:
   1. Ashcroft
   2. Omega
   3. Weiss
   4. Or equal.

F. Duct Thermometer Support Flanges:
   1. Trerice
   2. Ashcroft
   3. Weiss
   4. Marshaltown
   5. Weksler
   6. Or equal.

G. Differential and Filter Pressure Gauges:
   1. Orange Gauges
2. Midwest
3. Or equal.

H. Pressure-Gauge Fittings:
1. Omega
2. Weiss
3. Trerice
4. Or equal.

I. Test Plugs:
1. Petes Plug
2. Or equal.

J. Thermal Energy Flowmeters:
1. Onicon
2. Kamstrup
3. Or equal.

2.2 PRESSURE GAUGES

A. ASME B40.100, phosphor-bronze bourdon type, dry type.
   1. Case: Cast aluminum, stem-mounted, flangeless.
   2. Size: 4-1/2 inch (115 mm) diameter.
   5. Scale: White aluminum with black graduation and markings.
   7. Mid-Scale Accuracy: One percent.
   8. Scale: Psi.

2.3 THERMOMETERS

A. Adjustable Angle: Red-or blue-appearing organic liquid in glass: ASTM E 1; lens front tube,
cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking
device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9-inch scale.
   2. Window: Acrylic.
   3. Scale: Aluminum, white background, black graduations and markings.
   5. Accuracy: 2 percent, per ASTM E 77.

2.4 DIAL THERMOMETERS

A. ASTM E 1, cast aluminum case, vapor or liquid actuated with brass or copper bulb, copper or
bronze braided capillary, white with black markings and black pointer, glass lens, adjustable
360 degrees in horizontal plane. 180 degrees in vertical plane.
   1. Size: 4-1/2-inch diameter dial.
   2. Lens: Clear glass.
   3. Length of Capillary: Minimum 6-feet (for remote reading if required).
4. Accuracy: 2 percent.
5. Calibration: 2 Degrees F. graduations.

2.5 SEPARABLE SOCKETS

A. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.
   1. Material: Brass, for use in copper piping.
   4. Insertion Length: To extend to center of pipe.
   5. Cap: Threaded, with chain permanently fastened to socket.
   6. Heat Transfer Fluid: Oil or graphite.

2.6 THERMOMETER WELLS

A. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
   4. Insertion Length: To extend to center of pipe.
   5. Cap: Threaded, with chain permanently fastened to socket.
   6. Heat Transfer Fluid: Oil or graphite.

2.7 DUCT THERMOMETER SUPPORT FLANGES

A. Description: Flanged fitting bracket for mounting in hole of duct, with threaded end for attaching thermometer.
   1. Extension Neck Length: Nominal thickness of 2-inches, but not less than thickness of exterior insulation.
   2. Insertion-Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation lining.

2.8 DIFFERENTIAL AND FILTER PRESSURE GAUGES

A. Service: Air and non-combustible, compatible gases (Natural Gas option available.)
B. Wetted Materials: Consult factory.
C. Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
D. Accuracy: Plus or minus 2 percent of full scale throughout range at 70 degrees F.
E. Pressure Limits: Minus 20 Hg to 15 PSIG.
F. Overpressure: Relief plug opens at approximately 25 PSIG standard gauges only.
G. Temperature Limits: 20 to 140 degrees F.

H. Size: 4-inch diameter dial face.

I. Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientation.

J. Process Connections: 1/8-inch female NPT duplicate high and low pressure taps, one pair side and one pair back.

K. Standard Accessories: Two 1/8-inch NPT plugs for duplicate pressure taps, two 1/8-inch pipe thread to rubber tubing adapter and three flush mounting adapters with screws.

2.9 PRESSURE-GAUGE FITTINGS

A. Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.

B. Syphons: NPS 1/4 (DN8) coil of brass turbine with threaded ends.

C. Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.10 TEST PLUGS

A. Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.

B. Body: Length as required to extend beyond insulation.

C. Pressure Rating: 500 PSIG (3450 kPa) minimum.

D. Core Inserts: One or two self-sealing valves, suitable for inserting 1/8-inch OD probe from dial-type thermometer or pressure gauge.

E. Core Material for Air, Water, Oil and Gas: 20 to 200 degrees F (Minus 7 to plus 93 Degrees Celsius), chlorosulfonated polyethylene synthetic rubber.

F. Test Plug Cap: Gasketed and threaded cap, with retention chain or strap.

G. Test Kit: Pressure gauge and adapter with probe, two bimetal dial thermometers, and carrying case.
   1. Pressure Gauge and Thermometer Ranges: Approximately two times the system's operating conditions.

2.11 THERMAL ENERGY FLOWMETERS

A. Instruments include turbine wheel flowmeter (see specification in this Section), two temperature sensors, transmitter, solid state calculator with integral battery pack, integral stop valves, strainer, and magnetic trap.
   3. Temperature Range: 40 to 250 degrees F.
4. Data Output: LCD output with readout in kilowatt hours or British thermal units (joules). BACnet compatible serial communication.
5. Accuracy: Plus or minus one percent.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Provide instruments with scale ranges selected according to service with largest appropriate scale.

3.2 PRESSURE GAUGES

A. Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.

B. Locations: Install in the following locations as a minimum, and elsewhere as indicated.
   1. At each pump inlet and outlet.
   2. At inlet and discharge of each pressure reducing valve.
   3. At makeup water service outlets.
   4. At inlet and discharge of each chiller and boiler.

C. Install in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust to final angle, clean windows and lenses, and calibrate to zero.

E. Pressure Gauge Range/Graduations:

<table>
<thead>
<tr>
<th>System</th>
<th>Pressure (PSI)</th>
<th>Graduations (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled Water</td>
<td>0-100</td>
<td>1</td>
</tr>
<tr>
<td>Heating Water</td>
<td>0-100</td>
<td>1</td>
</tr>
</tbody>
</table>

3.3 THERMOMETERS

A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

B. Install in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

C. Adjust to final angle, clean windows and lenses, and calibrate to zero.

D. Thermometer Range/Graduations:

<table>
<thead>
<tr>
<th>System</th>
<th>Temperature (degree F)</th>
<th>Graduations (degrees F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled Water</td>
<td>25-125</td>
<td>1</td>
</tr>
</tbody>
</table>
3.4 DIAL THERMOMETERS

A. Install in vertical upright position, tilted so as to be easily read at floor.

3.5 SEPARABLE SOCKETS

A. Inspect the openings in the vessel for foreign material and clean the connection ports to remove scale, chips and debris.

B. Install thermostats with separable sockets. Install the separable socket using good piping practice. Be sure to use TFE tape or pipe thread sealant on external pipe threads.

C. Never stand directly over or in front of a valve or controller when the system is pressurized.

D. Assure the separable socket is completely submerged in liquid or flow stream. Partial submersion will give erratic temperature transfer to thermostat.

E. Pack separable socket full with high temp bearing grease. This helps in heat transfer and prevents air space.

3.6 THERMOMETER WELLS

A. Install in piping in vertical upright position. Fill well with oil or graphite, secure cup.

3.7 DUCT THERMOMETER SUPPORT FLANGES

A. Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.

3.8 DIFFERENTIAL AND FILTER PRESSURE GAUGES

A. Install pressure gauge where exposure to heat and vibration are minimal and where the dial can be easily read. It is also important to install the gauge in a location with undisturbed and continuous flow of the pressure medium.

B. Provide a needle valve or gauge cock, installed between the process and the pressure gauges.

C. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.

D. Locations: Install in the following locations, and elsewhere as indicated.
   1. At each pump inlet and outlet.
   2. At inlet and discharge of each pressure reducing valve.
   3. At make-up water service outlets.

E. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
3.9 PRESSURE-GAUGE FITTINGS
A. Install per manufacturer's instructions and recommendations.
B. Reference "Pressure Gauges" Article above.

3.10 TEST PLUGS
A. Locate test plugs adjacent to thermometers and thermometer sockets, adjacent to pressure gauges and pressure gauge taps, adjacent to control device sockets, or where indicated.

3.11 THERMAL ENERGY FLOWMETERS
A. Install in accordance with manufacturer's instructions and as shown on drawings. Provide recommended upstream and downstream straight pipe length for accurate reading.
B. Calibrate meters according to manufacturer's written instructions after installation.

END OF SECTION
SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Balancing Valves
   2. Ball Valves
   3. Butterfly Valves
   4. Swing Check Valves
   5. Wafer Check Valves

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

B. Valves, General:
   1. Apollo
   2. Armstrong
   3. ASCO
   4. Cla-Val
5. Conbraco
6. Crane
7. Clow
8. Griswold
9. Hammond
10. Hays
11. Jenkins
12. Josam
13. Kennedy
14. Milwaukee
15. Mueller
16. Nibco
17. Red-White Valve
18. Smith
19. Stockham
20. Tour Anderson
21. Wade
22. Watts
23. Wilkins
24. Zurn
25. Or equal.

C. Balancing Valves:
   1. Griswold
   2. Hays
   3. Armstrong CBV
   4. Tour Anderson
   5. Or equal.

D. Ball Valves:
   1. See Valves General above.
   2. NSF Valves:
      a. Clow
      b. Kennedy
      c. Nibco
      d. Or equal.

E. Butterfly Valves:
   1. See Valves General above.

F. Swing Check Valves:
   1. See Valves General above.

G. Wafer Check Valves:
   1. See Valves General above.

2.2 VALVES - GENERAL

A. General:
   1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6 inches and smaller. Provide gear operators for quarter-turn valves 8 inches and larger and plug valves 5 inches and larger. Provide chain-operated sheaves and chains for overhead valves installed over 5 feet above finished floor.

3. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

B. Valves in Insulated Piping: With 2-inch stem extension and following features:
   1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
      a. Basis of Design Product: Subject to compliance with requirements. Provide NIBCO NIB-SEAL handle extension or comparable product by one of the following.
         1) Conbraco Industries, Inc.: Apollo Div.

C. Valve-End Connections:
   1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
   2. Grooved: With grooves according to AWWA C606.

D. Valve Bypass and Drain Connections: MSS SP-45.

E. Building Service:
   1. Shutoff and Isolation Valves:
      a. Pipe Sizes 3 Inches and Smaller: Ball valve.
      b. Pipe Sizes 4 Inches and Larger: Butterfly valve. Gate valve acceptable if allowed by Owner.
   2. Drain Service: Ball valves.
   4. Check Valves: Swing or Wafer.

2.3 BALANCING VALVES

A. Maximum 125 PSIG System Working Water Pressure.

B. Manual Set Balancing Valves:
   1. Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
      a. Precise flow measurement.
      b. Precision flow balancing.
      c. Positive drip-tight shutoff.
   2. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves have a minimum of five full 360 degree handwheel turns. 90 degree style ball valves are not acceptable. Valve handle to have
hidden memory feature, which will provide a means for locking the valve position after
the system is balanced. Valves to be furnished with precision machined venturi built into
the valve body to provide highly accurate flow measurement and flow balancing. The
venturi to have two 1/4-inch threaded brass metering ports with check valves and
gasketed caps located on the inlet side of the valve. The valve body, stem and plug to be
brass. The handwheel to be high-strength resin.

3. 2-1/2 Inches and Larger: Valve body to be either cast iron with integrated cast iron
flanges (2-1/2-inch to 12-inch) or ductile iron with industrial standard grooved ends
(2-1/2-inch to 12-inch). Valve stem and plug disc to be bronze with handwheel that
permits multi-turn adjustments. Sizes 2-1/2-inch and 3-inch: five turns; sizes 4-inch to
6-inch: 6 turns; sizes 8-inch to 10-inch: 12 turns; and size 12-inch: 14 turns. Provide
flange adapters to prevent rotation.

C. Automatic Balance Valve:
   1. 1/2 Inch and Larger: Construction and attachment style as required by piping system.
      Internal working parts and removable flow cartridge to be stainless steel. Valves be
      factory set and automatically limit flow to specified capacities with 5 percent plus or
      minus accuracy over entire operating pressure differential.

2.4 BALL VALVES

A. Ball valves on brazed piping are to be three-piece.

B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration,
bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, brass or
stainless steel ball, Teflon seat, brass stem, or extended steel handle. Apollo 77CLF 100 Series
two-piece.

C. 3 Inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze
body, extended soldered ends for copper pipe and threaded ends for iron pipe, brass or
stainless steel ball, Teflon seat, brass stem, or extended steel handle. Apollo 82-100/82A 140
Series three-piece.

D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated
or stainless steel ball and stem. TFE seats, 600 PSI.

2.5 BUTTERFLY VALVES

A. Select lug type valves.

B. 6 Inches and Smaller: 200 PSI, ductile iron body, extended neck, stainless steel stem with
stainless steel disc, reinforced resilient EPDM seat, memory stop control, lever handle through
5 inches, size and worm gear operator for 6 inches and larger. Mount stem in horizontal
position. Manual lever and lock Nibco LD2000, Gruvlok 7700 for mechanical coupling
fittings. MSS SP-67, Type 1.

C. 8 Inches and Larger: 200 PSI, ductile iron body, extended neck, stainless steel disc and stem
reinforced resilient EPDM seat, memory stop control, lever handle through 5 inches, size and
worm gear operator for 6 inches and larger. Mount stem in horizontal position. Manual lever
and Gruvlok Series 7700 for mechanical coupling fittings. MSS SP-67, Type 1.
2.6 **SWING CHECK VALVES**

A. 2 Inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80, Type 4.

B. 2-1/2 Inches and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Nibco F918. MSS SP-71, Type 1.

C. Gruvlok Check Valve: Horizontal installation. Working pressure to 300 PSI. Ductile body, ASTM A536, and stainless clapper, EPDM, nitrile or optional viton bumper and bonnet seals. Stainless wetted parts.

2.7 **WAFER CHECK VALVES**

A. Twin disc, Class 125 spring actuated designed to be installed with gaskets between two standard Class 125 flanges. 200 PSI, cast iron body, aluminum bronze disc. Nibco W-920-W.

B. Check Valve: PPS coated ductile iron body, ASTM A536, aluminum bronze nonslamming disc, stainless steel spring and shaft. Rubber seat for intended service.

**PART 3 - EXECUTION**

3.1 **GENERAL VALVE INSTALLATION REQUIREMENTS**

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and weld ends.
   3. Set angle valves closed to prevent rattling.
   4. Set ball open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.

B. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.

C. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.

D. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

E. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

F. Do not attempt to repair defective valves; replace with new valves.
G. Install valves per manufacturer’s recommendations.

H. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

I. Purge and clean piping to be connected to valve.

J. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.

K. Determine that the valve and its piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that mating flanges are in line and parallel to minimize straining on joints and valve body.

L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.

N. Stem Selection: Outside screw and yoke stems, except provide inside screw, nonrising stem where space prevents full opening of OS&Y valves.

O. Seats: Renewable seats, except where otherwise indicated.

P. When soldering, use paste flux that is approved by the manufacturer for use with lead-free alloys.

Q. Boiler isolation valves with adjustable packing gland per CSD-1 requirements.

R. Valve Adjusting and Cleaning:
   1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
   2. Valve Identification: Tag valves per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.

S. General Requirements for Valve Applications:
   1. If valve applications are not indicated, use the following:
      a. Shutoff Service: Ball valves.
      d. Pump-Discharge Check Valves:
         1) 2 Inches and Smaller: Swing or spring-loaded lift check valves with bronze disc.
         2) 2-1/2 Inches and Larger: Swing check valves with lever and weight or with spring or wafer - seat check valves.
e. Provide isolation valve, check valve, automatic flow control valve and balancing valve on discharge side of base mounted centrifugal pumps where indicated. Combination triple duty valves not allowed. Provide isolation valve and strainer on suction side of pump.

2. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

3. Valves, except wafer types, with the following end connections.
   a. For Copper Tubing 2 Inches and Smaller: Threaded ends.
   b. For Copper Tubing 2-1/2 Inches to NPS 4 Inches: Flanged ends.
   c. For Copper Tubing 5 Inches and Larger: Flanged ends.
   d. For Steel Piping 2 Inches and Smaller: Threaded ends.
   e. For Steel Piping 2-1/2 inches to NPS 4 Inches: Flanged ends.
   f. For Steel Piping 5 Inches and Larger: Flanged ends.

3.2 BALANCING VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install with flow in the direction of the arrow on the valve body and install at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Install devices in accordance with manufacturer's recommendations to automatically balance flow in piping loops as indicated.

C. For venturi valves less than 1-1/2-inch pipe size, provide valve sized for flow to coil. Provide transitions on both inlet and outlet of valve if valve is less than line size.

3.3 BALL VALVE INSTALLATION

A. See General Installation Requirements above.

3.4 BUTTERFLY VALVE INSTALLATION

A. See General Installation Requirements above.

3.5 SWING CHECK VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install in the horizontal or vertical position with upward flow. Install for proper direction of flow. Install with minimum three pipe diameters of straight pipe upstream of valve.

3.6 WAFER CHECK VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install between two flanges in horizontal or vertical position, position for proper direction of flow.

END OF SECTION
SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Hangers and Supports for HVAC Piping, Ductwork and Equipment
   2. Wall and Floor Sleeves
   3. Building Attachments
   4. Flashing
   5. Miscellaneous Metal and Materials

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   2. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
   3. Install ductwork and piping per SMACNA's requirements.
   4. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Welding:
      a. Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
   2. Welding for Hangers:
      a. Qualify procedures and personnel according to AWS D9.1, Sheet Metal Welding Code for duct joint and seam welding.
   3. Engineering Responsibility:
a. Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
   1) Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

4. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.

5. Support systems to be supplied by a single manufacturer.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 PERFORMANCE REQUIREMENTS

A. Provide pipe, ductwork and equipment hangers and supports in accordance with the following:
   1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor is responsible for their design.
   2. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems:
   1. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.
   2. Equipment, ductwork and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

E. Provide seismic restraint hangers and supports for piping, ductwork and equipment. See Section 23 05 48.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment. See Section 23 05 48.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hangers and Supports for HVAC Piping, Ductwork and Equipment:
   1. Anvil International
   2. B-Line Systems, Incorporated
   3. Erico Company, Incorporated
   4. Nelson-Olsen Incorporated
   5. Rilco Manufacturing Company, Incorporated
   6. Snappitz Thermal Pipe Shield Manufacturing
   7. Unistrut Corporation
   8. Or equal.

B. Wall and Floor Sleeves:
   1. Thunderline Corporation “Link Seal”.
   2. Or equal.

C. Building Attachments:
   1. Anchor-It
   2. Gunnebo Fastening Corporation
   3. Hilti Corporation
   4. ITW Ramset/Red Head
   5. Masterset Fastening Systems, Incorporated
   6. Or equal.

2.2 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.

B. Hanger Rod Couplings: Anvil Figure 136, B-Line Figure B3220, or equal; malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.

C. Channel Hanging System:
   1. Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A570 GR33, one side of channel to have a continuous slot within turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.
   2. Concrete Inserts: Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.

D. Continuous Concrete Insert: Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.
E. Pipe Hangers:
   1. Pipe Rings for Hanger Rods:
      a. Pipe Sizes 2-inches and Smaller: Adjustable swivel ring hanger, UL listed. Erico 100 or 101, Anvil Figures 69 or 104, or equal.
      b. Pipe Sizes 2-1/2-inches and Larger: Clevis type hangers with adjustable nuts on rod, UL listed. Anvil figure 260, Erico 400, or equal.
      c. Pipe hangers to have same finish as hanger rods.

F. Pipe Saddles and Shields:
   1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
   2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).

G. Riser Clamps: Steel, UL listed. MSS Type 8. Erico 510 or 511. Copper coated; Erico 368.

H. Pipe Slides: Anvil, reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resists corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.

I. Pipe Guides:
   1. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Contact with chilled water pipe not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
   2. Furnish and install guides approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be sued as supports and are in addition to other pipe hangers and supports.

J. Pipe Roller Hangers: Adjustable roller hanger. Black steel yoke, cast iron roller. MSS Type 41.

K. Below Ground Pipe Supports:
   2. Rod: 5/8-inch stainless steel Type 18-8.

L. Thermal Hanger Shield Inserts:
   1. 100-PSI (690-kPa) minimum compressive strength calcium silicate insulation, encased in sheet metal shield or polyisocyanurate rigid foam exceeding the load bearing weight of the pipe at the hanger point with a PVC vapor barrier.
   2. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier or polyisocyanurate rigid foam with a PVC vapor barrier.
3. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate or polyisocyanurate rigid foam with a PVC vapor barrier.
4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
5. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
6. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
7. Thermal Hanger Shield Insulation Operating Temperature: Meet or exceed fluid temperature in pipe.

M. Freestanding Roof Supports: Polyethylene high-density UV resistant quick "pipe" block with foam pad.

2.3 WALL AND FLOOR SLEEVES

A. Below Grade or High Water Table Areas:
1. "Link-Seal" Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal.
2. Provide Type S unless otherwise noted.

B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

C. Fabricated Accessories:
1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide the following minimum gauges for the sizes indicated:
   a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
   b. Sleeve Sizes 5-6-inches: 16 gauge.
   c. Sleeve Sizes 7-inches and Larger: 14 gauge.
   d. Fire-Rated Safing Material.
      1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 pounds per cubic foot density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
      2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.4 BUILDING ATTACHMENTS

A. Beam Clamps:
1. MSS Type 19 and 23, wide throat, with retaining clip.
2. Universal Side Beam Clamp: MSS Type 20.

B. Powder-Actuated Drive Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Anchor Bolts:
1. Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project structural engineer. Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

2. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.

3. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.


2.5 FLASHING

A. Steel Flashing: 26 gauge galvanized steel.

B. Safes: 8 mil thick neoprene.

C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

2.6 MISCELLANEOUS METAL AND MATERIALS

A. General:
   1. Provide miscellaneous metal items specified, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on drawings or otherwise not shown on drawings that are necessary for completion of the project. Contractor is responsible for their design.
   2. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or equal.

C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

G. Provide hot dipped galvanized components for items exposed to weather. Use materials compatible with system being supported (i.e. aluminum for aluminum ductwork, stainless steel for stainless steel ductwork).

H. Use straps, threshold rods and wire with sizes required by SMACNA to support ductwork.

I. Grout:
   1. ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
   2. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
   3. Properties: Nonstaining, noncorrosive, and non gaseous.
   4. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.

B. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall", "2-Hour Fire/Smoke Barrier", and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.

D. Equipment Clearances: Do not route ductwork, equipment, or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route ductwork, equipment, or piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact ductwork, equipment or pipe routing to provide proper clearance with such items.

3.2 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 SF with galvanized strips of No. 16 USS gauge steel 1-inch wide, and larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at a maximum of 8-feet on center.
B. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection.

C. Provide aluminum supports for aluminum ductwork.

D. Provide stainless steel supports for stainless steel ductwork.

E. Support vertical ducts at maximum intervals of 16-feet and at each floor.

F. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

G. Use double nuts and lock washers on threaded rod supports.

H. Floor supports in mechanical rooms to be elevated 1-inch above finish floor and void space filled with masonry grout.

I. Anchor ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps to roof deck. Do not support ducts from other ducts, piping or equipment.

J. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.

K. Construct exterior ductwork or ductwork which is otherwise exposed to weather watertight and slope 1/4-inch per foot to avoid standing water.

L. Exposed ductwork hung in clean areas such as sanitary areas, pharmaceutical areas, wash down areas or food process areas to be installed using double end, food grade trapeze hanger rods suitable for use with food grade strut.

M. Channel Support System Installation:
1. Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
2. Field assemble and install according to manufacturer's written instructions.

N. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

O. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

P. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

Q. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping, ductwork and equipment to proper level and elevations.
R. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

S. Horizontal Piping Hangers and Supports; Horizontal and Vertical Piping, and Hanger Rod Attachments:
   1. Factory fabricated horizontal piping hangers and supports complying with MSS SP-58, to suit piping systems and in accordance with manufacturer's published product information.
   2. Use only one type by one manufacturer for each piping service.
   3. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping.
   4. Pipe support spacing (pipe supported in ceiling or floor-supported) to meet latest applicable Code and manufacturer's requirements.
   5. Provide copper-plated hangers and supports for uninsulated copper piping systems.

T. Plumber's Tape not permitted as pipe hangers or pipe straps.

U. Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.

V. Pipe Ring Diameters:
   1. Uninsulated and Insulated Pipe, Except Where Oversized Pipe Rings are Specified: Ring inner diameter to suit pipe outer diameter.
   2. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.

W. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.

X. Pipe Support Brackets: Support pipe with pipe slides.

Y. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.

Z. Pipe Guides:
   1. Install on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Contact with chilled water pipe does not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
   2. Install approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.

AA. Heavy-Duty Steel Trapeze Installation:
   1. Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated, heavy-duty trapezes.
2. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

3. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

AB. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers. Maximum spacings: MSS SP-58.

AC. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.

AD. Do not support piping from other piping.

AE. Fire protection piping will be supported independently of other piping.

AF. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.

AG. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.

AH. Insulated Piping:
1. Attach clamps and spacers to piping.
   a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
2. Do not exceed pipe stress limits according to ASME B31.9.
3. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
4. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields to span arc of 180 degrees.
5. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
6. Shield Dimensions for Pipe, not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
   b. NPS 4 (DN100): 12-inches long and 0.06-inch thick.
   c. NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
   d. NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
   e. NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
7. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
   a. Insert Material: Length at least as long as protective shield.
8. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

AI. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

AJ. Pipe Curb Assemblies:
1. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.

2. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.

AK. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor walls, and through equipment room walls and floors.

AL. Vertical Piping:
   1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
   2. Riser clamps to be directly under fitting or welded to pipe.
      a. Riser to be supported at each floor of penetration.
      b. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

AM. Piping above roof to be supported with freestanding roof pipe supports unless detailed otherwise.

### 3.3 WALL AND FLOOR SLEEVES

A. "Link-Seal" Pipe Sleeves: Install at floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.

B. Fabricated Pipe Sleeves:
   1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirements, and by waterproofing requirements.
   2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
   3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
   4. Seal each end airtight with a resilient nonhardening sealer, UL listed, fire rated ASTM 814.

C. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
   1. Install fabricated pipe sleeve.
   2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
   3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814.

D. Piping Penetrations Through Fire-Rated (One to Three Hour) Assemblies:
1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814.

### 3.4 BUILDING ATTACHMENTS

A. Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions and in accordance manufacturer's published product information.

B. Select size of building attachments to suit hanger rods.

C. Install concrete inserts before placing concrete.

D. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

E. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4-inches thick.

F. Install within concrete or on structural steel or wood. Attachment to wood structure: Anvil side beam bracket Figure 202 for attachment to wooden beam or approved attachment for a wood structure.

G. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.

H. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.

I. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-58. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

K. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

L. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.

M. Anchor Bolts:
1. Install anchor bolts for mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment, piping and ductwork are hung.

2. Anchor bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

N. Testing: Test powder-actuated insert attachments with a minimum load of 100 pounds.

3.5 FLASHING

A. Flash and counterflash where piping, ductwork and equipment passes through weather or waterproofed walls, floors, and roofs.

B. Provide 12-inches minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

3.6 MISCELLANEOUS METAL AND MATERIALS

A. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.

B. Finishes:
   1. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
   2. Metal in Contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
   3. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.

E. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.

F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.


H. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.

I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

J. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

K. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

L. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
M. Provide galvanized components for items exposed to weather.

END OF SECTION
SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Vibration Isolation
   2. Seismic Restraint Devices
   3. Factory Finishes

B. General:
   1. Vibration isolation for mechanical ductwork, piping and equipment.
   2. Seismic restraint for mechanical ductwork, piping and equipment.
   3. Seismic Certification for equipment, hangers and systems
   4. Special inspections for systems.

C. Scope of Work:
   1. Vibration isolation and seismic restraint of new equipment and systems within project boundary defined in architectural drawings.
   2. Vibration isolation and seismic restraint of new equipment and systems in existing buildings to points of connection with existing systems.
   3. Seismic restraint of existing systems and equipment shown on drawings, within project boundary defined in architectural drawings.
   4. Provide supplementary structural steel for seismic restraint systems. No hanging from roof deck is permitted on this project, unless specifically allowed by Structural Engineer of Record in writing prior to bid.

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Vibration Isolation:
      a. Product Data: Provide catalog data indicating size, type, load and deflection of each isolator; and percent of vibration transmitted based on lowest disturbing frequency of equipment.
b. Shop Drawings: Showing complete details of construction for steel and concrete bases including:
   1) Fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment and cantilever loads.
   2) Equipment mounting holes.
   3) Dimensions.
   4) Size and location of concrete and steel bases and curbs.
   5) Isolation selected for each support point.
   6) Details of mounting brackets for isolator.
   7) Weight distribution for each isolator.
   8) Details of seismic snubbers.
   9) Code number assigned to each isolator.

c. Design calculations: Provide calculations for selecting vibration isolators and for designing vibration isolation bases.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

3. Seismic Restraint:
   a. Shop Drawings: Show compliance with requirements of Quality Assurance article of this Section. Shop drawings to be stamped by a professional Structural Engineer licensed in State of California.
   b. Calculations: Submit seismic calculations indicating restraint loadings resulting from design seismic forces. Include anchorage details and indicate quantity, diameter and depth of penetration of anchors. Calculations certified by professional Structural Engineer licensed in State of California.

4. Seismic Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter and depth of penetration of anchors.

5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y and z planes.


7. Equipment Certification: Provide seismic certification for equipment as noted in Seismic Design Summary or schedules on Drawings.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 014000, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Vibration Isolation:
      a. Except for packaged equipment with integral isolators, single manufacturer selects and furnishes isolation required.
      b. Deflections indicated on drawings are minimum actual static deflections for specific equipment supported.
c. Isolator Stability:
   1) Size springs of sufficient diameter to maintain stability of equipment being supported. Spring diameters not less than 0.8 of compressed height at rated load.
   2) Springs have minimum additional travel to solid equal to 50 percent of rated deflection.
   3) Springs support 200 percent of rated load, fully compressed, without deformation or failure.

d. Maximum Allowable Vibration Levels: Peak vibration velocities not exceed 0.08 in/sec. Correct equipment operating at vibration velocities that exceed this criteria.

2. Seismic Restraint:
   a. Code and Standard Requirements:
      1) Seismic restraint of equipment, piping and ductwork to be in accordance with latest enacted version of CBC Chapter 16.
   b. Confirm Seismic Control requirements in Structural documents.
   c. Certification: See Seismic Design Table or schedules on Drawings for equipment, systems and seismic-restraint devices designated to have seismic certification/qualification. Horizontal and vertical load testing and analysis performed according to ASCE 7-10. Anchorage systems to bear anchorage preapproval number from an agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing or calculations, if preapproved ratings are not available. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be sealed by qualified licensed professional engineer in State of California. Testing and calculations must include both shear and tensile loads and one test or analysis at 45 degrees to weakest mode.
   d. Seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure be designed to resist total design seismic force prescribed in local building code:
      1) Floor- or roof-mounted equipment weighing 400 pounds or greater.
      2) Suspended, wall-mounted or vibration isolated equipment weighing 20 pounds or greater.
      3) In-line duct devices connected to ductwork weighing 75 pounds or greater.
      4) Housekeeping slabs: provide reinforcement and anchorage to building structure.
   e. Where required, seismic sway bracing of suspended duct and piping meet following:
      1) Pipe and duct runs requiring seismic bracing have minimum of two traverse braces and one longitudinal brace. Longitudinal (or traverse) brace at 90 degree change in direction may act as traverse (or longitudinal) brace if located within 2-feet of change in direction.
      2) Seismic bracing may not pass through seismic separation joint. Pipe or duct runs that pass through seismic separation joint must be restrained within 5-feet of both sides of separation.
      3) Seismic brace assembly spacing not to exceed 40-feet transverse and 80-feet longitudinal.
   f. Seismic restraints may be omitted from suspended piping and duct if following conditions are satisfied:
1) For piping or ducts supported by rod hangers 12-inches or less in length from top of duct to bottom of structural support. Top connections to structure have swivel joints, eye bolts, or vibration isolation hangers for entire length of system run.

2) Lateral motion of system will not cause damaging impact with surrounding systems or cause loss of system vertical support.

3) System must be welded steel pipe, brazed copper pipe, sheet metal duct or similar ductile material with ductile connections.

C. Seismic restraints, including anchors to building structure, be designed by registered professional Structural Engineer licensed in State of California. Design includes:
   1. Number, size, capacity and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both unit to curb and curb to structure.
   2. Number, size, capacity and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations and test data verifying horizontal and vertical ratings of seismic restraint devices.
   3. Number, size, capacity and location of braces and anchors for suspended piping and ductwork on as-built plan drawings.
   4. Maximum seismic loads to be indicated on drawings at each brace location. Drawings bear stamp and signature of registered professional Structural Engineer who designed layout of braces.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Seismic Snubber Units: Furnish replacement neoprene inserts for snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vibration Isolation:
   1. The VMC Group
   2. B-Line Systems, Inc.
   4. Mason Industries Inc.
   5. M.W. Sausse - Vibrex
   6. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.
   7. Or equal.
B. Seismic Restraint Devices:
   1. The VMC Group
   2. B-Line Systems, Inc.
   3. Hilti, Inc.
   5. Mason Industries, Inc.
   6. California Dynamics Corporation
   7. Cooper B-Line Tolco.
   8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
   9. M.W. Sausse - Vibrex
   10. Or equal.

C. Factory Finishes:
   1. Kynar 500 Fluoropolymer Coating
   2. Or equal.

D. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork:
   1. The VMC Group
   2. California Dynamics Corporation
   3. Cooper B-Line, Inc.
   4. Hilti, Inc.
   5. Mason Industries, Inc.
   7. Unistrut
   8. ISAT, Inc.
   9. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.
   10. Or equal.

2.2 VIBRATION ISOLATION

A. Type 1 - Neoprene Pad: Natural rubber waffle pads, arranged in single or multiple layers, 3/4-inch thick per layer with pattern repeating on ½-inch centers; 50 durometer hardness; maximum loading 60 PSI. 1/4-inch thick steel load distribution plate between layers and between pad and equipment, factory cut to sizes matching requirements of supported equipment. Molded bridge with neoprene anchor bolt bushing and flat washer face to prevent metal to metal contact. Number of layers required for equipment scheduled. Mason Type: Super WMH.

B. Type 2 - Neoprene Mount: Double-deflection type, with ductile-iron housing containing two separate and opposing, oil-resistant natural rubber or bridge bearing neoprene elements, factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Neoprene elements to prevent metal to metal contact during normal operation. Minimum static deflection of 0.20-inches. Mason Type: BR.

C. Type 3 - Spring: Freestanding, laterally stable, open-spring isolators.
   1. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
2. Minimum Additional Travel: 50 percent of required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside. Baseplates limit floor load to 100 PSIG (690 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
7. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
8. Mason Type: SLFH.

D. Type 4a - Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
1. Housing: Steel with resilient vertical-limit stops (out of contact during normal operation) to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation. Restraining bolts have large rubber grommets to provide cushioning in vertical and horizontal directions. A minimum clearance of 3/8-inch maintained around restraining bolts so as not to interfere with spring action.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
7. Mason Type: SLR.

E. Type 4b - Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint with neoprene acoustical cup, spring inspection ports and rebound adjustment ports.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.
4. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
5. Mason Type: SSLFH.

F. Type 5a - Restrained Elastomeric Hangers: Double-deflection type, with molded, oil-resistant natural rubber or bridge bearing neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range. Seismic rebound steel and bonded LDS rubber washer to limit upward seismic movement. Mason Type: RWHD.
G. Type 5b- Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
   1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.
   2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
   3. Minimum Additional Travel: 50 percent of required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
   7. Mason Type: 30N.

H. Type 5c - Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
   1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.
   2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
   3. Minimum Additional Travel: 50 percent of required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
   7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
   8. Mason Type: RW30.

I. Type 6 - Horizontal Thrust Restraints: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.
   1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
   2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
   3. Minimum Additional Travel: 50 percent of required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
   7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.
   8. Mason Type: WBI or WBD.
J. Type 7 - Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on isolation material of 500 PSIG (3.45 MPa) and for equal resistance in all directions. Mason Type: ADA.

K. Type 8 - Resilient Pipe Vertical Sliding Guide: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin be removable and reinsertable to allow for selection of pipe movement. Guides be capable of motion to meet location requirements. Mason Type: VSG. Provide pipe expansion hangers to control load shifts as the riser expands or contracts, Mason HES.

L. Type FC-1, Flexible duct connectors. See Specification Section 23 33 00 Air Duct Accessories.

M. Type FC-2A, Flexible Pipe Connector, Steel:
   1. 321 stainless steel, close pitch, annular corrugated hose.
   2. Exterior Sleeve: 304 stainless steel, braided.
   3. Pressure Rating: 125 PSI at 70 degrees F for 12-inch and smaller pipe.
   5. Size: Use pipe sized units.
   6. Minimum Allowable Offset: 3/4-inch on each side of installed center line.
   7. Basis of Design: Metraflex Model MLP.

N. Type FC-2B, Flexible Pipe Connector, Copper:
   1. Inner Hose: Bronze, close pitch, annular corrugated hose.
   2. Exterior Sleeve: Braided bronze (for piping over 2-inches, to be 3 pound braided stainless steel).
   3. Minimum Allowable Pressure Rating: 125 PSI at 70 degrees F.
   5. Size: Use pipe sized units.
   7. Basis of Design: Metraflex Model BBS.

O. Type FC-2C, Flexible Pipe Connector, Gas:
   1. Inner Hose: 304 stainless steel.
   2. Exterior Sleeve: Braided, 304 stainless steel.
   3. Minimum Allowable Pressure Rating: 150 PSI at 70 degrees F up to 4-inch pipe.
   5. Minimum Allowable Offset: 3/4-inch on each side of installed center line.
   6. Basis of Design: Metraflex GASCT.

P. Type FC-3, Flexible Compensator, Double Sphere:
   1. Body: Molded twin spherical type. Neoprene with internal cord or wire.
   2. Minimum Pressure Rating, Sizes 2-inch to 12-inch: 225 PSI at 170 degrees F.
   3. Minimum Pressure Rating, Sizes 14-inch to 20-inch: 125 PSI at 170 degrees F.
8. Joint: Steel flanges.
9. Accessories: Galvanized aircraft-type cable or control rods to prevent over extension.

2.3 SEISMIC RESTRAINT DEVICES

A. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.

B. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts and replaceable resilient isolation washers and bushings. Snubber load rating to match equipment size. Mason Type: Z-1011 or Z-1225.
1. Anchor bolts for attaching to concrete be seismic-rated, drill-in and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.

C. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Mason Type: SCB.

D. Anchor Bolts: Seismic-rated, drill-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.4 FACTORY FINISHES

A. Provide manufacturer's standard prime-coat finish ready for field painting. Units mounted outdoors exposed to weather: Epoxy powder coated, with 1000 hour salt spray rating per ASTM B-117. For high levels of corrosion protection utilize:
1. Conform to AAMA 605.2.
2. Apply coating following cleaning and pretreatment.
3. Cleaning: AA-C12C42R1X.
4. Dry system before final finish application.
5. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees F for 10 minutes.

B. Finish:
1. Manufacturer's standard paint applied to factory-assembled and factory-tested equipment before shipping.
2. Powder coating on springs and housings.
3. Hardware be electrogalvanized. Hot-dip galvanize metal components for exterior use.
4. Baked enamel for metal components on isolators for interior use.
5. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.
2.5 SEISMIC-BRACING/RERAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

A. General Requirements for Restraint Components: Rated strengths, features and applications to be as defined in reports by agency acceptable to authorities having jurisdiction.

B. Structural Safety Factor: Allowable strength in tension, shear and pullout force of components be at least four times maximum seismic forces to which they will be subjected.

C. Anchor bolts for attaching to concrete to be seismic-rated, drill-in and stud-wedge or female-wedge type.

D. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

E. Maximum 1/4-inch air gap and minimum 1/4-inch thick resilient cushion.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Set floor-mounted equipment with steel base rails on 4-inch-high concrete housekeeping pads. Extend pad 6-inches beyond footprint of equipment in each direction.

B. Provide mounts for equipment installed outdoors for wind loads of 30 lbs. psf applied to any exposed surface of isolated equipment.

C. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.

D. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances is isolation efficiency to be destroyed when bolting isolators to floor.

E. Building Penetrations: Isolate water piping and ductwork penetrating wall, ceilings, floors or shafts from structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe or duct at equipment room wall.

F. Provide roof curbs, equipment supports and roof penetrations. Work to maintain roof warranty. Coordinate location, size, structural connections/requirements and flashing prior to installation.

G. Install Type 6 horizontal thrust restraints at centerline of thrust, symmetrical on either side of equipment.

H. Vibration isolators must not cause change of position of equipment or piping which would stress piping connections or misalignment shafts or bearings. Isolated equipment is to be level and in proper alignment with connecting ducts and pipes.
I. Pipe Hangers in Equipment Rooms: Support water and gas piping connected to rotating equipment within equipment rooms on spring and neoprene hangers. The first three hangers from a piece of vibrating equipment are to have a minimum of 1/2 static deflection of equipment isolators. Other isolators should have a minimum of 1/4 static deflection of equipment isolators.

J. Examination:
   1. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances and other conditions affecting performance.
   2. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

K. Testing: Perform following field quality-control testing:
   1. Isolator seismic-restraint clearance.
   2. Isolator deflection.
   3. Snubber minimum clearances.

L. Adjusting:
   1. Adjust snubbers according to manufacturer's written recommendations.
   2. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

M. Cleaning: After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt and debris.

N. Demonstration: Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain air-mounting systems. Reference 01820, Demonstration and Training.

3.2 VIBRATION ISOLATION

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Vibration isolators must be installed in strict accordance with manufacturer's written instructions and certified submittal data.

D. Install isolation as indicated on drawings by type and location and where indicated below.

E. Equipment Vibration Isolation Schedule:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Size</th>
<th>Vibration Isolator Type</th>
<th>Minimum Deflection (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Set Centrifugal Fans</td>
<td>All</td>
<td>4A</td>
<td>1.5</td>
</tr>
</tbody>
</table>
F. Isolation Mounts:
   1. Install minimum of four seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
   2. Install resilient bolt isolation washers on equipment anchor bolts.
   3. Provide flexible piping connection and flexible ductwork connection to equipment with isolation mounts or bases.

G. Isolating Hangers:
   1. Support piping and ductwork connected to isolated equipment within equipment rooms on isolating hangers as scheduled on drawings. Unless otherwise noted, first three hangers from isolated equipment to have a minimum of 1/2 static deflection of equipment isolators. Other isolating hangers to have a minimum of 1/4 static deflection of equipment isolators.
   2. Position isolating hanger elements as high as possible in hanger rod assembly, but not in contact with building structure. Install hangers so that hanger housing may rotate full 360 degrees about rod axis without contacting any object.
   3. Unless otherwise noted, air supply units with internally isolated fans do not require isolating hangers for connecting pipes and ductwork.
   4. Where parallel running pipes are hung together on an isolated trapeze, provide isolator deflections for largest determined by provisions for pipe isolation. Do not mix isolated and non-isolated pipes in same trapeze.
   5. Install limit stops so they are out of contact during normal operation.

H. Adjusting:
   1. Adjust isolators after piping systems have been filled and equipment is at operating weight.
   2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
   3. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

3.3 SEISMIC RESTRAINT DEVICES

A. Reference 3.01, General Installation Requirements.

B. Install in strict accordance with manufacturer's written instructions and certified submittal data.

C. Install and adjust seismic restraints so equipment, piping and ductwork supports are not degraded by restraints.

D. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.

E. Install restraining cables at each trapeze, individual pipe hanger and hanging vibration isolated equipment. Provide restraining cables in each of the four directions of movement. Install
restraining cables no less than 45 Degrees from vertical. At trapeze anchor locations, shackles piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

F. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackles piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

3.4 FACTORY FINISHES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Finishes to be factory-applied. No field patching or holidays allowed.

3.5 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION
SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY
A. Work Included:
   1. Plastic Nameplates
   2. Tags
   3. Plastic Pipe Markers
   4. Ceiling Tags

1.2 RELATED SECTIONS
A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS
A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS
A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.
B. In addition, provide:
   1. Schedules:
      a. Submit valve schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut off and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.

1.5 QUALITY ASSURANCE
A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
B. In addition, meet the following:
   1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
   2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.
1.6  **WARRANTY**

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

**PART 2 - PRODUCTS**

2.1  **MANUFACTURERS**

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23, HVAC Sections. Where more than a single type is specified for application, provide single selection for each product category.

B. Plastic Nameplates:
   1. Brady Corporation
   2. Brimar
   3. Champion America
   4. Craftmark
   5. Seton
   6. Or equal.

C. Tags:
   1. Brady Corporation
   2. Brimar
   3. Champion America
   4. Craftmark
   5. Seton
   6. Or equal.

D. Plastic Pipe Markers:
   1. Brady Corporation
   2. Brimar
   3. Champion America
   4. Craftmark
   5. Seton
   6. Or equal.

E. Ceiling Tags:
   1. Brady Corporation
   2. Brimar
   3. Champion America
   4. Craftmark
   5. Seton
   6. Or equal.
2.2 PLASTIC NAMEPLATES

A. Description: Engraving stock melamine plastic laminate in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color), punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Provide 1/8-inch thick material.
   2. Letter Height: 1/2-inch.
   4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
   5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 2-inch diameter.

B. Metal Tags: Polished Brass with stamped letters; tag size minimum 2-inch diameter with smooth edges.

C. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.

D. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

E. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.

F. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
   1. Size: Approximately 4 by 7-inches.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

2.4 PLASTIC PIPE MARKERS


B. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
C. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Lettering:
   1. 3/4-inch to 1-1/4-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 1/2-inch high letters.
   2. 1-1/2-inch to 2-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 3/4-inch high letters.
   3. 2-1/2-inch to 6-inch Outside Diameter of Insulation or Pipe: 12-inch long color field, 1-1/4-inch high letters.
   4. 8-inch to 10-inch Outside Diameter of Insulation or Pipe: 24-inch long color field, 2-1/2-inch high letters.
   5. Over 10-inch Outside Diameter of Insulation or Pipe: 32-inch long color field, 3-1/2-inch high letters.

2.5 CEILING TAGS

A. Description: Steel with 3/4-inch diameter color coded head.

B. Color code as follows:
   1. Yellow - HVAC equipment.
   2. Red - Fire dampers/smoke dampers.
   4. Ceiling tile labels, machine generated, adhesive backed tape labels with black letters, clear tape.

PART 3 - EXECUTION

3.1 GENERAL - INSTALLATION

A. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.

B. Identify ductwork with plastic ductmarkers.

C. Identify piping, concealed or exposed, with plastic pipe markers.

D. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

E. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).
F. Degrease and clean surfaces to receive adhesive for identification materials.

G. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

H. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.

I. Install all products in accordance with manufacturer's instructions.

J. Manual Balancing Dampers: Provide 12-inch long orange marker ribbon to end of balancing damper handle.

3.2 PLASTIC NAMEPLATES

A. Install plastic nameplates with corrosive-resistant mechanical fasteners.

B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.

C. Identify thermostats with nameplates.

3.3 TAGS

A. Use metal tags on piping 3/4-inch diameter and smaller.

B. Tag balancing valves and major dampers with balanced GPM or CFM indicated after balancing is completed and accepted.

C. Install tags with corrosion resistant chain.

D. Small devices, such as in-line pumps, may be identified with tags.

E. Identify valves in main and branch piping with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.

F. Identify air terminal units and radiator valves with numbered plastic tags.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Install valve schedule at each mechanical room.

3.4 PLASTIC PIPE MARKERS

A. Install plastic pipe markers complete around pipe in accordance with manufacturer's instructions.
B. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

3.5 CEILING TAGS

A. Provide ceiling tile labels to identify valves, dampers, and equipment above accessible ceilings.

B. Provide ceiling tags to locate valves, dampers, and equipment above accessible ceilings. Locate in corner of ceiling tee grid closest to equipment.

END OF SECTION
SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. General Requirements and Procedures
   2. Fundamental Air Systems Balancing Procedures
   3. Temperature Control Verification
   4. Constant Volume Air Systems Balancing Procedures
   5. Variable Air Volume Systems Additional Procedures
   6. Pre-Balance Reporting
   7. Final Reports:
      a. Report Requirements
      b. General Report Data
      c. System Diagrams
      d. Air Handling Units
      e. Fans
      f. Duct Traverses
      g. Diffusers/Registers/Grilles
      h. Instrument Calibration
   8. Additional Tests

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Quality-Assurance Submittals: Submit two copies of evidence that the Testing, Adjusting, and Balancing (TAB) Agent and this Project's TAB team members meet the qualifications specified in the "Quality Assurance" Article below.
   2. Pre-Construction Phase Report:
      a. Provide a pre-construction phase TAB Plan at least two weeks prior to the commencement of TAB work. This report is to include:
         1) A complete set of report forms intended for use on the project, with data filled in except for the field readings. Forms to be Project-specific.
2) Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
3) Identification of the type, manufacturer, and model of the actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications are to be included.
4) A narrative of any project specific and/or non-standard TAB procedures to be used, and the equipment or systems they apply to.

3. Contract Documents Examination Report: Within 45 days from the Contractor’s Notice to Proceed, submit two copies of the Contract Documents review report as specified in Part 3 of this Section.


5. Specify reports required because of editing procedures in Part 3 of this Section.

6. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by the TAB Agent.

7. Sample Report Forms: Submit two sets of sample TAB report forms.

8. Test Instrument Calibration: Submit proof of calibration within the last 6 months.


10. Provide additional submittals to commissioning authority as dictated in commissioning specifications.

1.5 QUALITY ASSURANCE

A. Quality Assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Acceptable Manufacturers:
      a. California:
         1) Raglen System Balance
         2) Pacific Test & Balance, Inc.
         3) Air Test & Balance, Inc.
         4) RSA Analysis, Inc.
         5) Air Balance Co. Inc.
         6) Total Air Balance Co. Inc.
         7) National Air Balance Company (NABCO)
         8) Mesa 3
   2. Acceptable Balance Firm:
      a. General:
         1) Procure services of independent TAB agency to balance, adjust and test water circulating and air moving equipment and air distribution or exhaust systems. Minimum experience: 5 years.
      b. Industry Standards: Testing and Balancing will conform to NEBB, American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), and American National Standards Institute (ANSI) as follows:
2) ASHRAE: Comply with recommendations pertaining to measurements, instruments, and TAB.

3) ANSI:
   a) S1.4 Specifications for sound level meters.
   b) S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.
   c) ANSI S1.13 Methods for the Measurement of Sound Pressure Levels.

c. Test Observation: If requested, conduct tests in the presence of the Architect or the Architect's representative.

3. Noise Criteria:
   a. Noise levels in all 8 octave bands due to equipment and duct systems are not to exceed the following NC levels:

<table>
<thead>
<tr>
<th>TYPE OF ROOM</th>
<th>NC LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference Room</td>
<td>30-35</td>
</tr>
<tr>
<td>Corridors (Public)</td>
<td>35-40</td>
</tr>
<tr>
<td>Lobbies, Waiting Areas</td>
<td>35-40</td>
</tr>
<tr>
<td>Offices, Large Open (3 or more occupants)</td>
<td>35-40</td>
</tr>
<tr>
<td>Offices, Small Private (2 or fewer occupants)</td>
<td>30-35</td>
</tr>
<tr>
<td>Kitchens</td>
<td>40-45</td>
</tr>
<tr>
<td>Classrooms (Small, Medium, Large)</td>
<td>30-35</td>
</tr>
<tr>
<td>Cafeteria/Dining</td>
<td>35-40</td>
</tr>
<tr>
<td>All Others</td>
<td>35-40</td>
</tr>
</tbody>
</table>

   b. For equipment which has no sound power ratings scheduled on the Drawings, select equipment that the foregoing noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure in accordance with ASHRAE Fundamentals Handbook, Chapter 7, Sound and Vibration.

   c. An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.

   d. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

4. Allowable Vibration Tolerances for Rotating, Non-Reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.
5. Provide proof of testing agency having successfully completed at least five projects of similar size and scope.

6. Code Compliance: Perform tests in the presence of the Authority Having Jurisdiction (AHJ) where required by the Authority Having Jurisdiction (AHJ).

7. Owner Witness: Perform tests in the presence of the Owners representative.

8. Engineer Witness: The engineer or engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.

9. Simultaneous Testing: Test observations by the AHJ, the Owner's representative and the engineer's representative need not occur simultaneously.

10. Do not perform TAB work until heating, ventilating, and air conditioning equipment has been completely installed and is operating continuously as required.

11. Conduct air testing and balancing with clean filters in place. Clean strainers prior to performing hydronic testing and balancing.

12. Agent Qualifications: Engage a TAB agent certified by AABC or NEBB.

13. TAB Conference: Meet with the Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.
   a. Agenda Items: Include at least the following:
      1) Submittal distribution requirements.
      2) Contract Documents examination report.
      3) TAB plan.
      4) Work schedule and Project site access requirements.
      5) Coordination and cooperation of trades and subcontractors.
      6) Coordination of documentation and communication flow.

14. Certification of TAB Reports: This certification includes the following:
   a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.


16. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards and NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

17. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

B. In addition, provide:
   1. TAB Agency provides warranty for a period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10 percent
of total number of terminals, or resetting of any outlet, coil, or device listed in the final
TAB report.

2. Guarantee: Meet the requirements of the following programs:
   a. Provide a guarantee on AABC or NEBB forms stating that the agency will assist in
      completing the requirements of the Contract Documents if the TAB Agent fails to
      comply with the Contract Documents. Guarantee includes the following
      provisions:
         1) The certified Agent has tested, adjusted, and balanced systems according to
            the Contract Documents.
         2) Systems are balanced to optimum performance capabilities within design
            and installation limits.

1.7 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce
   fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches,
   and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high
   air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn
   from a persons skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable
   results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a
   closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause
   reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of
   a fan when installed under conditions different from those presented when the fan was
   performance tested.

J. TAB: Testing, Adjusting, and Balancing.

K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the
   distribution system.

L. Test: A procedure to determine quantitative performance of a system or equipment.

M. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and
   reporting the TAB procedures.
1.8 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS AND PROCEDURES

A. Project Conditions:
   1. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire TAB period. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.
   2. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.
   3. Non-Owner Occupancy: Complete balancing of building systems prior to Substantial Completion and owner occupancy.

B. General Requirements:
   1. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and controls, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.
   2. Perform TAB work with doors, closed windows, and ceilings installed etc., to obtain simulated or project operating conditions. Do not proceed until systems scheduled for TAB are clean and free from debris, dirt and discarded building materials.
   3. Where Owner occupies building during the testing period, cooperate with Owner to minimize conflicts with Owner's operations.

C. Examination:
1. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
   a. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
   b. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

2. Examine approved submittal data of HVAC systems and equipment.

3. Examine project record documents described in Section 01780, Project Record Documents.

4. Examine Architect's and Engineer's design data, including Basis of Design, HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

5. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

6. Coordinate requirements in system and equipment with this Section.

7. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

8. Examine system and equipment test reports.

9. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

10. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

11. Examine equipment for installation and for properly operating safety interlocks and controls.


13. Beginning of work means acceptance of existing conditions.

D. Preparation:

1. Prepare a TAB plan that includes strategies and step-by-step procedures.

2. Complete system readiness checks and prepare system readiness reports. Verify the following:
   a. Permanent electrical power wiring is complete.
b. Hydronic systems are filled, clean, and free of air.
c. Automatic temperature-control systems are operational.
d. Equipment and duct access doors are securely closed.
e. Balance, smoke, and fire dampers are open.
f. Isolating and balancing valves are open and control valves are operational.
g. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
h. Windows, doors and other portions of the building envelope can be closed so design conditions for system operations can be met.

3. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   a. Attendance is required by installers whose work will be tested, adjusted, or balanced.

4. Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.

E. General TAB Procedures:
   1. Perform TAB procedures on each system according to the procedures contained in AABC national standards or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
   2. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
   3. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

F. Adjustment Tolerances:
   1. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
   2. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
   3. Hydronic Systems: Adjust to within plus or minus 10 percent of design at coils and plus or minus 5 percent at system pumps and equipment.
   4. Adjust supply, return, and exhaust air quantities to maintain pressurization in spaces indicated on Drawings. Note and document room-to-room pressurization and maintain these relationships. Adjust pressure controlled spaces to within plus or minus 0.01 in WC.

G. Recording and Adjusting:
   1. Field Logs: Maintain written logs including:
      a. Running log of events and issues.
      b. Discrepancies, deficient or uncompleted work by others.
      c. Contract interpretation requests.
      d. Lists of completed tests.
   2. Ensure recorded data represents actual measured or observed conditions.
3. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
4. Mark on drawings locations where traverse and other critical measurements were taken and cross reference location in final report.
5. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
6. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
7. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner's Representative, or Commissioning Agent.

3.2 FUNDAMENTAL AIR SYSTEMS BALANCING PROCEDURES

A. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

B. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.

C. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

D. Prepare test reports for both fans and inlets and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross check the summation of required outlet volumes with required fan volumes.

E. Prepare schematic diagrams of systems' "as-built" duct layouts.

F. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

G. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

H. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

I. Verify that motor starters are equipped with thermal protection, sized for the connected load.

J. Check dampers for proper position to achieve desired airflow path.

K. Check for airflow blockages.

L. Check that condensate drains are installed, trapped and primed and routed to drain.

M. Check for readily observable leaks in air-handling unit components and ductwork.

N. Use sheaves and pulleys to adjust the speed of belt drive fans to achieve design flow with motors running at 60 Hertz unless noted otherwise.
3.3 TEMPERATURE CONTROL VERIFICATION

A. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices operate by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.
   3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
   4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
   5. Thermostats and humidistats are located to avoid adverse effects of sunlight, equipment, drafts, and cold walls.
   6. Sensors are located to sense only the intended conditions.
   7. Sequence of operation for control modes is according to the Contract Documents.
   8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
   9. Interlocked systems are operating.
   10. Changeover from heating to cooling mode occurs according to design values.

B. Verify that controllers are calibrated and commissioned.

C. Check transmitter and controller locations and note conditions that would adversely affect control functions.

D. Record controller settings and note variances between set points and actual measurements.

E. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

F. Verify free travel and proper operation of control devices such as damper and valve operators.

G. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

H. Confirm interaction of electrically operated switch transducers.

I. Confirm interaction of interlock and lockout systems.

J. Verify main control supply-air pressure and observe compressor and dryer operations.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.4 CONSTANT VOLUME AIR SYSTEMS BALANCING PROCEDURES

A. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer. Adjust fans to deliver design airflow at the lowest possible speed.
   1. Measure fan static pressures to determine actual static pressure as follows:
      a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each air-handling unit component under final balanced condition.

3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Recommend corrective action to align design and actual conditions.

4. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

5. Do not make fan-speed adjustments that result in motor loading greater than full load amps. Do not increase fan speed beyond fan class rating. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

6. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

7. Calibrate airflow measuring stations.

3.5 VARIABLE AIR VOLUME SYSTEMS ADDITIONAL PROCEDURES

A. Compensating for Diversity:

1. When the total airflow of terminal units is more than the fan design airflow volume, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the design airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

2. Pressure-Independent, Variable-Air Volume Systems:

a. After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

   1) Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.

   2) Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure to deliver design airflow at the terminal unit.

   3) Measure total system airflow. Adjust to within 10 percent of design airflow.

   4) Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use the terminal unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units.

   5) Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow.

   a) If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
6) Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets.

7) Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure adequate static pressure is maintained at the most critical unit. Balance system to achieve the lowest required differential pressure for the system to minimize fan brake horsepower.

8) Balance terminal units in variable volume systems for maximum cooling, maximum heating, and minimum ventilation (demand based ventilation systems) airflow rates.

9) Record the final fan performance data.

3. Pressure-Dependent, Variable-Air Volume Systems with Diversity:
   a. After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
      1) Set system at maximum design airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
      2) Adjust supply fan to maximum design airflow with the variable-airflow controller set at maximum airflow.
      3) Set terminal units being tested at full-airflow condition.
      4) Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to design airflow. When total airflow is correct, balance the air outlets downstream from terminal units.
      5) Adjust terminal units for minimum airflow.
      6) Measure static pressure duct system at the sensor.
      7) Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets.
      8) Measure supply return and outside airflows with dampers at full economizer position.

4. Additional Requirements: Provide all additional procedures to compensate for diversity as prescribed in ASHRAE and/or NEBB standards.

5. Calibrate airflow measuring stations.

3.6 PRE-BALANCE REPORTING

A. Pre-Construction Phase Report:
   1. Provide a pre-construction phase TAB Plan at least 2 weeks prior to the commencement of TAB work. This report is to include:
      a. A complete set of report forms intended for use on the project, with all data filled in except for the field readings. Forms to be project specific.
      b. Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
      c. Identification of the type, manufacturer, and model of actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications are to be included.
d. A narrative of any project specific and/or non-standard TAB procedures to be used, and the equipment or systems they apply to.

B. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

C. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced.

3.7 FINAL REPORTS

A. Report Requirements:
   1. General:
      a. Computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
      b. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.
         1) Include a list of the instruments used for procedures, along with proof of calibration.
      c. Final Report Contents: In addition to the certified field report data, include the following:
         1) Pump curves.
         2) Fan Curves
         3) Manufacturers Test Data
         4) Field test reports prepared by system and equipment installers.
         5) Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

B. General Report Data:
   1. In addition to the form titles and entries, include the following data in the final report, as applicable:
      a. Title Page
      b. Name and Address of TAB Agent
      c. Project Name
      d. Project Location
      e. Architect's Name and Address
      f. Engineer's Name and Address
      g. Contractor's Name and Address
      h. Report Date
      i. Signature of TAB Agent who Certifies the Report
      j. Summary of Contents, Including the Following:
         1) Design versus Final Performance
         2) Notable Characteristics of Systems
3) Description of System Operation Sequence if it varies from the Contract Documents

k. Nomenclature Sheets for Each Item of Equipment

l. Data for Terminal Units, including Manufacturer, Type Size, and Fittings

m. Notes to explain why certain final data in the body of reports vary from design values.

n. Test Conditions for Fans and Pump Performance Forms, Including the Following:
   1) Settings for Outside-, Return-, and Exhaust-air Dampers
   2) Conditions of Filters
   3) Cooling Coil, Wet- and Dry-bulb Conditions
   4) Face and Bypass Damper Settings at Coils
   5) Fan Drive Settings, including Settings and Percentage of Maximum Pitch Diameter
   6) Inlet Vane Settings for Variable-Air-Volume Systems
   7) Settings for Supply-air, Static-pressure Controller
   8) Other System Operating Conditions that affect Performance

C. System Diagrams:
   1. Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
      a. Quantities of Outside, Supply, Return, and Exhaust Airflows
      b. Water and Steam Flow Rates
      c. Duct, Outlet, and Inlet Sizes
      d. Pipe and Valve Sizes and Locations
      e. Terminal Units
      f. Balancing Stations

D. Air Handling Units:
   1. For air-handling units, split systems, fan coils, pumps, and evaporator units with coils, include the following:
      a. Unit Data: Include the following:
         1) Unit Identification
         2) Location
         3) Make and Type
         4) Model Number and Unit Size
         5) Manufacturer's Serial Number
         6) Unit Arrangement and Class
         7) Discharge Arrangement
         8) Sheave Make, Size in inches, and Bore
         9) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
        10) Number of Belts, Make, and Size
        11) Number of Filters, Type, and Size
      b. Motor Data: Include the following:
         1) Make and Frame Type and Size
         2) Horsepower and rpm
         3) Volts, Phase, and Hertz
         4) Full-load Amperage and Service Factor
         5) Sheave Make, Size in Inches, and Bore
6) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches

c. Test Data: Include design and actual values for the following:
1) Total Airflow Rate in cfm (L/s)
2) Total System Static Pressure in Inches wg (Pa)
3) Fan rpm
4) Discharge Static Pressure in Inches wg (Pa)
5) Filter Static-pressure Differential in Inches wg (Pa)
6) Preheat Coil Static-pressure Differential in Inches wg (Pa)
7) Cooling Coil Static-pressure Differential in Inches wg (Pa)
8) Heating Coil Static-pressure Differential in Inches wg (Pa)
9) Outside Airflow in cfm (L/s)
10) Return Airflow in cfm (L/s)
11) Outside-air Damper Position
12) Return-air Damper Position
13) Vortex Damper Position

E. Fans:
1. Fan Test Reports: For supply, return, and exhaust fans, include the following:
   a. Fan Data: Include the following:
      1) System Identification
      2) Location
      3) Make and Type
      4) Model Number and Size
      5) Manufacturer's Serial Number
      6) Arrangement and Class
      7) Sheave Make, Size in Inches, and Bore
      8) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches.
   b. Motor Data: Include the following:
      1) Make and Frame Type and Size
      2) Horsepower and rpm
      3) Volts, Phase, and Hertz
      4) Full-load Amperage and Service Factor
      5) Sheave Make, Size in Inches, and Bore
      6) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
      7) Number of Belts, Make, and Size
   c. Test Data: Include design and actual values for the following:
      1) Total Airflow Rate in cfm
      2) Total System Static Pressure in Inches wg
      3) Fan rpm
      4) Discharge Static Pressure in Inches wg
      5) Suction Static Pressure in Inches wg

F. Duct Traverses:
1. Include a diagram with a grid representing the duct cross-section and record the following:
   a. Report Data: Include the following:
      1) System and Air-handling Unit Number
      2) Location and Zone
3) Traverse Air Temperature in Degrees F
4) Duct Static Pressure in Inches wg
5) Duct Size in Inches
6) Duct Area in SF
7) Design Airflow Rate in cfm
8) Design Velocity in fpm
9) Actual Airflow Rate in cfm
10) Actual Average Velocity in fpm
11) Barometric Pressure in PSIG

G. Diffusers/Registers/Grilles:
   1. For diffusers, registers and grilles, include the following:
      a. Unit Data: Include the following:
         1) System and Air-handling Unit Identification
         2) Location and Zone
         3) Test Apparatus Used
         4) Area Served
         5) Air-terminal-device Make
         6) Air-terminal-device Number from System Diagram
         7) Air-terminal-device Type and Model Number
         8) Air-terminal-device Size
         9) Air-terminal-device Effective Area in SF
      b. Test Data: Include design and actual values for the following:
         1) Airflow Rate in cfm
         2) Air Velocity in fpm
         3) Preliminary Airflow Rate as Needed in cfm
         4) Preliminary Velocity as Needed in fpm
         5) Final Airflow Rate in cfm
         6) Final Velocity in fpm
         7) Space Temperature in Degrees F

H. Instrument Calibration:
   1. For instrument calibration, include the following:
      a. Report Data: Include the following:
         1) Instrument Type and Make
         2) Serial Number
         3) Application.
         4) Dates of Use
      b. Dates of Calibration.

3.8 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION
SECTION 23 07 00
HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Type A, Flexible Glass Wool Blanket
   2. Type B, Duct Liner
   3. Type 1, Glass Wool Pipe Insulation
   4. Type 2, Flexible Elastomeric Pipe Insulation
   5. Jacketing
   6. Accessories
   7. Duct Insulation Accessories
   8. Duct Insulation Compounds

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Installer qualifications.
   2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.
   3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
   4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
   5. Submit manufacturer's installation instructions.
1.5 QUALITY ASSURANCE
A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
   2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
   3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
   4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.6 WARRANTY
A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 FIRE HAZARD CLASSIFICATION
A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.

B. Test pipe insulation in accordance with the requirements of current edition of UL "Pipe and Equipment Coverings R5583 400 8.15".

C. Test duct insulation in accordance with current edition of ASTM E84, UL 723, NFPA 255, NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Type A, Flexible Glass Wool Blanket:
   1. Certainteed
   2. Johns Manville
   3. Knauf
   4. Owens-Corning
   5. Or equal.

B. Type B, Duct Liner:
   1. Certainteed
   2. Johns Manville
   3. Knauf
   4. Owens-Corning
   5. Or equal.

C. Type 1, Glass Wool Pipe Insulation:
1. Certainteed
2. Johns Manville
3. Knauf
4. Owens-Corning
5. Or equal.

D. Type 2, Flexible Elastomeric Pipe Insulation:
   1. Glue:
      a. Armacell LLC Armaflex Low VOC Adhesive
      b. Halstead
      c. Or equal.
   2. Paint:
      a. Armacell LLC Armaflex
      b. Halstead
      c. Or equal.

E. Jacketing:
   1. ITW Insulation Systems
   2. Or equal.

F. Accessories:
   1. ITW Insulation Systems
   2. Or equal.

G. Duct Insulation Accessories:
   1. Certainteed
   2. Johns Manville
   3. Owens-Corning
   4. Or equal.

H. Duct Insulation Compounds:
   1. Certainteed
   2. Johns Manville
   3. Owens-Corning
   4. Or equal.

2.2 TYPE A, FLEXIBLE GLASS WOOL BLANKET

A. ASTM C553, Type 1, Class B-2; flexible blanket.

B. 'K' Value: 0.27 BTU*in/(hr*sf*F) at 75 degrees F installed, maximum service temperature: 250 degrees F.

C. Density: 0.75 pounds per cubic foot.

D. Vapor Barrier Jacket: FSK aluminum foil reinforced with glass wool yarn and laminated to fire resistant Kraft, secured with UL listed pressure sensitive tape or outward clinched expanded staples and vapor barrier mastic as needed.

E. DBDE-free. UL/E validated to be formaldehyde-free.
2.3 **TYPE B, DUCT LINER**

A. ASTM C1071; flexible blanket.

B. 'K' Value: ASTM C518, 0.25 BTU*in/(hr*sf*F) at 75 degrees F, maximum service temperature: 250 degrees F.

C. Noise Reduction Coefficient: 0.65 or higher based on ASTM C 423 "Type A mounting."

D. Maximum Velocity on Mat or Coated Air Side: 5,000 FPM.

E. Adhesive: UL listed waterproof type.

F. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.


H. ASTM G21 and ASTM G22 Microbial Growth Resistance.

I. UL GREENGUARD Certified does not support the growth of mold, fungi, or bacteria per ASTM C 1338 and meets UL Environment GREENGUARD Microbial Resistance Listing per UL 2824-“GREENGUARD Certification Program Method for Measuring Microbial Resistance”. DBDE-free. UL/E validated to be formaldehyde-free.

2.4 **TYPE 1, GLASS WOOL PIPE INSULATION**

A. Glass Wool: ASTM C547 Type I and IV; rigid molded, noncombustible.

1. Thermal Conductivity Value: As indicated in the insulation tables below.
2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.
3. Vapor Retarder Jacket: White Kraft paper reinforced with glass wool and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.5 **TYPE 2, FLEXIBLE ELASTOMERIC PIPE INSULATION**

A. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.

1. Thermal Conductivity Value: As indicated in the insulation tables below.
2. Maximum Service Temperature of 220 degrees F.
4. Maximum Smoke Developed: 50 (1-inch thick and below).
5. Connection: Waterproof vapor retarder adhesive as needed.
6. UV Protection: UV outdoor protective coating per manufacturer's requirements.

B. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam. Armacell LLC Armaflex Low VOC adhesive, Halstead, or equal.

C. Paint: Nonhardening high elasticity type, specifically manufactured as protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather. Armacell LLC Armaflex, Halstead, or equal.
2.6 **JACKETING**

A. Canvas Jacket: Ul listed fabric, 6 ounce/sq. yd., plain weave cotton treated with dilute fire retardant lagging adhesive.

B. PVC preformed molded insulation covers. Zeston or equal.

C. Aluminum Jacket: 0.016-inch-thick sheet, (smooth/embossed) finish, with longitudinal slip joints and 2-inch laps, die-shaped fitting covers with factory attached protective liner.

D. Stainless Steel Jacket: Type 304 stainless steel, 0.010-inch, smooth finish.

2.7 **ACCESSORIES**

A. Equipment Insulation Jacketing: Presized glass cloth, not less than 7.8 ounces/sq.yd., except as otherwise indicated. Coat with gypsum based cement.

B. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

C. General: Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have the same flame and smoke component ratings as the insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide nonwater soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

2.8 **DUCT INSULATION ACCESSORIES**

A. Staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

2.9 **DUCT INSULATION COMPOUNDS**

A. Cements, adhesives, coatings, sealers, protective finishes and similar accessories as recommended by insulation manufacturer for applications indicated.

**PART 3 - EXECUTION**

3.1 **GENERAL INSTALLATION REQUIREMENTS**

A. Verification of Conditions:
   1. Do not apply insulation until pressure testing and inspection of ducts and piping has been completed.
   2. Examine areas and conditions under which duct and pipe insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Preparation: Clean and dry surfaces to be insulated.
C. Installation:
   1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
   2. Piping and Equipment:
      a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.
      b. Cover insulation on pipes above ground, outside of building, with aluminum jacketing. Position seam on bottom of pipe.

D. Provide accessories as required. See Part 2 Article "Accessories" above.

E. Protection and Replacement: Installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

F. Glass Wool Insulation:
   1. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate the vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.
   2. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use performed PVC molded insulation covers.

G. Labeling and Marking: Provide labels, arrows and color on piping and ductwork. Attach labels and flow direction arrows to the jacketing per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.

H. Ductwork:
   1. Install insulation in conformance with manufacturer's recommendations to completely cover duct.
   2. Butt insulation joints firmly together and install jackets and tapes smoothly and securely.
   3. Apply duct insulation continuously through sleeves and prepared openings, except as otherwise specified. Apply vapor barrier materials to form complete unbroken vapor seal over insulation.
   4. Coat staples and seals with vapor barrier coating.
   5. Cover breaks in jacket materials with patches of same material as vapor barrier. Extend patches not less than 2-inches beyond break or penetration on all directions and secure with adhesive and staples. Seal staples and joints with vapor barrier coating.
   6. Fill jacket penetrations. i.e., hangers, thermometers and damper operating rods, and other voids in insulation with vapor barrier coating. Seal penetration with vapor barrier coating. Insulate Hangers and Supports for cold duct in un-conditioned spaces to extent to prevent condensation on surfaces.
   7. Seal and flash insulation terminations and pin punctures with reinforced vapor barrier coating.
8. Continue insulation at fire dampers and fire/smoke dampers up to and including those portions of damper frame visible at outside of the rated fire barrier. Insulating terminations at fire dampers in accordance with this Section.

9. Do not conceal duct access doors with insulation. Install insulation terminations at access door in accordance with this Section.

I. Insulated Pipe Exposed to Weather: Where piping is exposed to weather, cover insulation with aluminum jacket. Seal watertight jacket per manufacturer's recommendations. Install metal jacket with 2-inch overlap at longitudinal and butt joints with exposed lap pointing down. Secure jacket with stainless-steel draw bands 12-inches on center and at butt joints.

J. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 2-inches and larger for steam and chilled water piping.

K. Ductwork Surfaces to be Insulated:

<table>
<thead>
<tr>
<th>Item to be Insulated</th>
<th>System Insulation Type</th>
<th>Duct Size</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply ductwork where duct is not specified to be lined.</td>
<td>A</td>
<td>All</td>
<td>1-1/2-inch</td>
</tr>
<tr>
<td>Return ductwork where duct is not specified to be lined or where ductboard is not utilized.</td>
<td>--</td>
<td>All</td>
<td>None</td>
</tr>
<tr>
<td>Duct Silencers</td>
<td>C</td>
<td>All</td>
<td>1-1/2-inch</td>
</tr>
<tr>
<td>Outside Air Ducts</td>
<td>A</td>
<td>All</td>
<td>3-inch</td>
</tr>
<tr>
<td>HVAC plenums and unit housings not preinsulated</td>
<td>B</td>
<td>All</td>
<td>1-1/2-inch</td>
</tr>
<tr>
<td>Grease Exhaust</td>
<td>E</td>
<td>All</td>
<td>Per rating level</td>
</tr>
<tr>
<td>Exposed insulation in mechanical rooms or areas subject to damage</td>
<td>C,D</td>
<td>All</td>
<td>1-1/2-inch</td>
</tr>
</tbody>
</table>

1. Note: Insulation thickness shown is a minimum. If state codes require additional thickness, then provide insulation thickness per code requirements.

L. Piping Surfaces to be Insulated:
<table>
<thead>
<tr>
<th>Item to be Insulated</th>
<th>System Insulation Type</th>
<th>Conductivity Range (Btu-inch per hour per SF per degrees F)</th>
<th>Pipe Size (inches)</th>
<th>Insulation Thickness (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating (141F to 200F)</td>
<td>1,4</td>
<td>0.25-0.29 at a mean rating temperature of 125 degrees F</td>
<td>&lt;1 1 to &lt;1.5</td>
<td>1.5 1.5</td>
</tr>
<tr>
<td>Heating (105F to 140F)</td>
<td>1,4</td>
<td>0.22-0.28 at a mean rating temperature of 100 degrees F</td>
<td>&lt;1 1 to &lt;1.5</td>
<td>1.0 1.0</td>
</tr>
<tr>
<td>Chilled Water (40F to 60F)</td>
<td>1,4</td>
<td>0.21-0.27 at a mean rating temperature of 75 degrees F</td>
<td>&lt;1 1 to &lt;1.5</td>
<td>0.5 0.5</td>
</tr>
</tbody>
</table>

1. Note: Insulation thickness shown is a minimum. If state code requires additional thickness, then provide insulation thickness per code requirements.

3.2 TYPE A, FLEXIBLE GLASS WOOL BLANKET

A. Install insulation in conformance with manufacturer's recommendations and requirements.

B. Duct Wrap: Cover air ducts per insulation table except ducts internally lined where internal duct lining is adequate to achieve adequate insulating values to meet local Energy Codes (indicate on shop drawings, locations where duct wrap is planned to be omitted and indicate internal duct lining insulating values to confirm they will meet the Energy Code.) Wrap tightly with circumferential joints butted and longitudinal joints overlapped minimum of 2-inches. On ducts over 24-inches wide, additionally secure insulation with suitable mechanical fasteners at 18-inches on center. Circumferential and longitudinal joints stapled with flare staples 6-inches on center and covered with 3-inch wide, foil reinforced tape.

3.3 TYPE B, DUCT LINER

A. Install insulation in conformance with manufacturer's recommendations and requirements.

B. Duct Liners: Mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with continuous (minimum 90) percent coat of adhesive. Secure liner with mechanical fasteners 15-inches on center or per manufacturer requirements. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom Sections of insulation overlap sides. Factory/field coat exposed edges. Metal nosing for exposed leading or transverse edges and when velocity exceeds 3500 FPM or manufacturer rating on exposed edges. Keep duct liner clean and free from dust. At completion of project, vacuum duct liner if it is dirty or dusty. Do not use small pieces. If insulation is installed without horizontal, longitudinal, and
end joints butted together, installation will be rejected and work removed and replaced with work that conforms to this Specification.

3.4 **TYPE 1, GLASS WOOL PIPE INSULATION**

A. Install insulation in conformance with manufacturer's recommendations and requirements.

B. See General Installation Requirements above.

C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.

D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

E. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 2-inches and larger (hot and cold piping).

3.5 **TYPE 2, FLEXIBLE ELASTOMERIC PIPE INSULATION**

A. Flexible Elastomeric Insulation:
   1. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and below grade with two coats of finish as recommended by manufacturer.

B. Flexible Elastomeric Tubing:
   1. Flexible Elastomeric Tubing: Slip insulation over piping or, if piping is already installed, slit insulation and snap over piping. Joints and butt ends must be adhered with 520 adhesive.

C. Install insulation in conformance with manufacturer's recommendations and requirements.

D. See General Installation Requirements above.

E. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.

F. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 2-inches and larger (hot and cold piping).

G. Install in accordance with manufacturer's instructions for below grade installation.
3.6 JACKETING
   A. See General Installation Requirements above.
   B. Install in accordance with manufacturer's instructions.

3.7 ACCESSORIES
   A. Install insulation in conformance with manufacturer's instructions, recommendations and requirements.
   B. See General Installation Requirements above.
   C. Provide and install accessories for all insulation types listed in this Section.

3.8 DUCT INSULATION ACCESSORIES
   A. Install insulation in conformance with manufacturer's recommendations and requirements.

3.9 DUCT INSULATION COMPOUNDS
   A. Install insulation in conformance with manufacturer's recommendations and requirements.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Definitions, warranties, test equipment requirements, and mechanical commissioning requirements.

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

B. In addition, reference the following:
   1. Section 01 91 13, General Commissioning Requirements.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Certificates of readiness.
   2. Certificates of completion of installation, prestart, and startup activities.
   3. Operation and Maintenance Manuals.
   4. Test reports.
   5. Control Drawings Submittal
      a. Provide a key to abbreviations.
      b. Provide graphic schematic depictions of the systems and each component.
      c. Include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
      d. Provide a full points list with at least the following included for each point:
         1) Controlled system
         2) Point abbreviation
         3) Point description
         4) Display unit
         5) Control point or set point (Yes / No)
         6) Monitoring point (Yes / No)
         7) Intermediate point (Yes / No)
8) Calculated point (Yes / No)
6. Architect forwards one set of submittals for systems to be commissioned to Commissioning Agent at same time as design team.
7. Commissioning Agent forwards comments to design team for consideration in their submittal response.
8. Design team sends consolidated response to submittals and copies to Commissioning Agent.

1.5 QUALITY ASSURANCE
A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
B. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to Commissioning Authority upon request.

1.6 WARRANTY
A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.
B. In addition, provide:
   1. Commissioning, inspecting, and testing will not modify terms or time periods of mechanical equipment, systems, and controls warranties including related equipment and systems, and adjacent work.
   2. Control system warranty period starts from date of Commissioning Agent acceptance.

1.7 COORDINATION
A. Reference Section 01 91 13, General Commissioning Requirements, for requirements pertaining to coordination during the commissioning process.

1.8 PURPOSE
A. Purpose of commissioning process is to provide Owner assurance that systems have been installed in prescribed manner and will operate within performance guidelines. Commissioning is intended to enhance quality of system startup and aid in orderly transfer of systems to beneficial use by Owner.
B. Commissioning procedures and results will be observed by Commissioning Authority or Owner's staff. Contractor is expected to verify functional readiness of systems to be tested prior to performing the tests in presence of Owner's witness. A high rate of test failure will indicate that Contractor has not adequately verified readiness of systems.
PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide standard testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested. For example, the mechanical contractor of Division 23, HVAC will ultimately be responsible for standard testing equipment for the HVAC&R system and controls system in Division 23, HVAC, except for the equipment specific to and used by TAB in their commissioning responsibilities. Provide a sufficient quantity of two-way radios by each subcontractor.

B. Include special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing in the base bid price to the Owner and leave on site, except for stand-alone data logging equipment that may be used by the Commissioning Authority.

C. Manufacturer of equipment to provide proprietary test equipment and software required for programming and/or start-up, whether specified or not. Manufacturer provides the test equipment, demonstrates its use, and assists in the commissioning process as needed. Proprietary test equipment (and software) become the property of the Owner upon completion of the commissioning process.

D. Data logging equipment and software required to test equipment will be provided by the Commissioning Authority, and will not become the property of the Owner.

E. Use only testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers have a certified calibration within the past year to an accuracy of 0.5 degree F and a resolution of plus or minus 0.1 degree F. Pressure sensors have an accuracy of plus or minus 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the Commissioning Authority will prepare prefunctional checklists for commissioned components, equipment, and systems

B. Red-Lined Drawings:
   1. Verify equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.
   2. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
   3. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings.
   4. The contracted party, as defined in the Contract Documents will create the as-built drawings.
C. Operation and Maintenance (O&M) Data:
   1. Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for commissioned equipment and systems.
   2. The Commissioning Authority will review the O&M literature once for conformance to project requirements.
   3. The Commissioning Authority will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.

D. Demonstration and Training:
   1. Contractor will provide demonstration and training as required by the specifications.
   2. A complete training plan and schedule must be submitted by the contractor to the Commissioning Authority four weeks prior to any training.
   3. A training agenda for each training session must be submitted to the Commissioning Authority one week prior the training session.
   4. Notify the Commissioning Authority at least 72 hours in advance of scheduled tests so that testing may be observed by the Commissioning Authority and Owner's representative. Provide a copy of the test record to the Commissioning Authority, Owner, and Architect.
   5. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specific equipment.
   6. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment.
   7. Review data in O&M Manuals.

E. Systems Manual Requirements:
   1. The Systems Manual is intended to be a usable information resource containing the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross references.
   2. Include final approved versions of the following information for the Systems Manual:
      a. Facility Description.
      c. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information.
      d. Overview of each commissioned system including operational schedules and sequence of operations.
      e. General maintenance recommendations and procedures.
      f. Recommendations for recalibration frequency of sensors and actuators.
      g. Recommended best practices for keeping the system running efficiently.
      h. Blank Functional Performance Tests so the Owner can recommission the facility at a later date.
   3. Organize and arrange information by building system, such as fire alarm, chilled water, heating hot water, etc.
   4. Provide Information in an electronic version to the extent possible. Legible, scanned images are acceptable for non-electronic documentation to facilitate this deliverable.
3.2 CONTRACTOR'S RESPONSIBILITIES

A. Mechanical, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors of Division 23, HVAC are as follows (references apply to commissioned equipment only):
   1. Perform commissioning tests at the direction of the Commissioning Authority.
   2. Attend construction phase controls coordination meetings.
   3. Attend testing, adjusting, and balancing review and coordination meetings.
   4. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the Commissioning Authority.
   5. Provide information requested by the Commissioning Authority for final commissioning documentation.
   6. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or subcontract written.
   7. Prepare preliminary schedule for mechanical system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, testing and balancing and task completion for owner. Distribute preliminary schedule to commissioning team members.
   8. Update schedule as required throughout the construction period.
   9. During the startup and initial checkout process, execute the related portions of the prefunctional checklists for commissioned equipment.
  10. Contractor to participate and complete checklists using the Commissioning Authority's web based commissioning software Facility Grid. A desktop, laptop, tablet, or iPad will be required.
  11. Assist the Commissioning Authority in verification and functional performance tests.
  12. Gather operation and maintenance literature on equipment, and assemble in binders as required by the specifications. Submit to Commissioning Authority 45 days after submittal acceptance.

B. Coordinate with the Commissioning Authority to provide 48 hour advance notice so that the witnessing of equipment and system start-up and testing can begin.

C. Notify the Commissioning Authority a minimum of two weeks in advance of the time for start of the testing and balancing work. Attend the initial testing and balancing meeting for review of the official testing and balancing procedures.

D. Participate in, and schedule vendors and contractors to participate in the training sessions.

E. Provide written notification to the Construction Manager/General Contractor (CM/GC) and Commissioning Authority that the following work has been completed in accordance with the Contract Documents, and that the equipment, systems, and sub-system are operating as required.
   1. HVAC&R equipment including fans, air handling units, ductwork, dampers, terminals, and other equipment furnished under this Division.
   2. Fire stopping in the fire rated construction, including fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.
   3. Fire detection and smoke detection devices furnished under other divisions of the specification.
F. Equipment supplier to document the performance of his equipment.

G. Test, Adjust and Balance Contractor:
   1. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
   2. Participate in verification of the testing and balancing report, which will consist of repeating measurements contained in the testing and balancing reports. Assist in diagnostic purposes when directed.

H. Provide training of the Owner's operating staff using expert qualified personnel, as specified.

I. Equipment Suppliers:
   1. Provide requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
   2. Assist in equipment testing per agreements with contractors.
   3. Provide information requested by Commissioning Authority regarding equipment sequence of operation and testing procedures.

J. Reference Section 01 91 13, General Commissioning Requirements for additional contractor responsibilities.

3.3 OWNER'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for Owner's Responsibilities.

3.4 DESIGN PROFESSIONAL'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for Design Professional's Responsibilities.

3.5 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for Commissioning Authority's Responsibilities.

3.6 TESTING PREPARATION

A. Certify in writing to the Commissioning Authority that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the Commissioning Authority that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the Commissioning Authority.

3.7 TESTING, ADJUSTING AND BALANCING VERIFICATION

A. Prior to performance of Testing, Adjusting and Balancing work, provide copies of reports, sample forms, checklists, and certificates to the Commissioning Authority.

B. Notify the Commissioning Authority at least 10 days in advance of testing and balancing Work, and provide access for the Commissioning Authority to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the Commissioning Authority.
   1. The Commissioning Authority will notify testing and balancing subcontractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
   2. Testing and balancing subcontractor to use the same instruments (by model and serial number) that were used when original data were collected.
   3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items to result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB to result in rejection of final testing. Variations in background noise must be considered.
   4. Remedy the deficiency and notify the Commissioning Authority so verification of failed portions can be performed.

3.8 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the Commissioning Authority.

B. Scope of HVAC&R testing to include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing to include measuring capacities and effectiveness of operational and control functions.

C. Test operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The Commissioning Authority along with the HVAC&R contractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor to prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the Commissioning Authority and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The Commissioning Authority may direct that set points be altered when simulating conditions is not practical.

H. The Commissioning Authority may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.9 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 23, HVAC Sections. Provide submittals, test data, inspector record, and certifications to the Commissioning Authority.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23, HVAC Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the Commissioning Authority with preparation of testing plans.

C. Pipe System Cleaning, Flushing, Hydrostatic Tests, and Chemical Treatment: Test requirements are specified in Division 23, HVAC Piping Sections. HVAC&R Contractor to prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the Commissioning Authority. Plan to include the following:
   1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Provide drawings keyed to pipe zones or sectors formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
   2. Description of equipment for flushing operations.
   4. Tracking checklist for managing and ensuring that pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
D. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of components, systems and sub-systems. Evaluate the following equipment and systems:
   1. HVAC Equipment and Systems (all)
   2. Building Automation System
   3. Pumps
   4. VFDs

3.10 DEFICIENCIES/NONCONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Reference Section 01810/01 91 13, General Commissioning Requirements, for requirements pertaining to deficiencies/nonconformance, cost of retesting, or failure due to manufacturer defect.

3.11 OPERATION AND MAINTENANCE MANUALS

A. The Operation and Maintenance Manuals to conform to Contract Documents requirements as stated in Division 23, HVAC.

B. Provide an updated as-built version of the control drawings and sequences of operation in the final controls O&M manual submittal.

3.12 TRAINING OF OWNER PERSONNEL

A. Mechanical Contractor's Training Responsibilities:
   1. Provide the Commissioning Authority with a training plan two weeks before the planned training.
   2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, HVAC equipment (i.e., pumps, heat exchangers, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.).
   3. Training starts with classroom sessions followed by hands-on training on each piece of equipment to illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
   4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
   5. The appropriate trade or manufacturer's representative provides the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
   6. Controls contractor to attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

8. Training Includes:
   a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
   b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. Training to include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
   c. Discussion of relevant health and safety issues and concerns.
   d. Discussion of warranties and guarantees.
   e. Common troubleshooting problems and solutions.
   f. Explanatory information included in the O&M manuals and the location of plans and manuals in the facility.
   g. Discussion of any peculiarities of equipment installation or operation.

9. Schedule training after functional testing is complete, unless approved otherwise by the Owner.

B. Controls Contractor's Training Responsibilities:
   1. Provide the Commissioning Authority and A/E with a training plan four weeks before the planned training.
   2. Provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on the capabilities of the control system.
   3. Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals include detailed description of the subject matter for each session. Manuals to cover control sequences and have a definitions section that fully describes relevant words used in the manuals and in software displays. Manuals will be approved by the Commissioning Authority and A/E. Deliver copies of audiovisuals to the Owner.
   4. The trainings will be tailored to the needs and skill-level of the trainees.
   5. The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. Owner to approve the instructor prior to scheduling the training.
   6. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
   7. Attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
   8. Three Training Sessions, as Follows:
      a. Training I - Control System. The first training consists of eight hours of actual training. This training may be held on-site or in the supplier's facility. If held off-site, the training may occur prior to final completion of the system installation. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
b. Training II - Building Systems. The second session held on-site for a period of eight hours of actual hands-on training after the completion of system commissioning. The session includes instruction on:

1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.

2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing set points and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

3) Trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.

4) Completely discuss every screen, allowing time for questions.

5) Use of keypad or plug-in laptop computer at the zone level.

6) Use of remote access to the system via phone lines or networks.

7) Setting up and changing an air terminal unit controller.

8) Graphics generation.

9) Point database entry and modifications.

10) Understanding DDC field panel operating programming (when applicable).

c. Training III - The third training will be conducted on-site six months after occupancy and consist of eight hours of training. The session will be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the system.

END OF SECTION
SECTION 23 09 00
INSTRUMENTATION AND CONTROL PERFORMANCE SPECIFICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Communications
   2. Operator Interface
   3. Controller Software
   4. Web Based Access
   5. BAS Graphics
   6. Building Controllers
   7. Application Specific Controllers
   8. Application Specific Controller - Terminal Unit Controllers
   9. Input/Output Interface
   10. Power Supplies and Line Filtering
   11. Control Panels
   12. Auxiliary Control Devices
   13. Wiring and Raceways
   14. Smoke Detection for Projects with a Building Fire Alarm System

B. This is a performance specification and Contractor is responsible for design tasks and engineering.

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   2. Current edition of UL 916 Underwriters Laboratories Standard for Energy Management Equipment, Canada and the US.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
1. Prepare and submit a detailed schedule of work. Schedule to identify milestones such as equipment submittals, control panel diagrams, color graphic panel displays, Interlock.

2. Wiring diagrams, control program sequence software flow chart diagrams, conduit layout diagrams, device location diagrams, equipment and component deliveries, installation sequencing, controller startup, point to point startup, control programming, sequence testing, commissioning/acceptance testing and training.

3. Submit design drawings, sequences of operation, program listings, software flow charts and details for each typical piece of equipment and system being controlled. No work to be initiated or fabrication of any equipment started prior to the Owner's Representatives return of REVIEWED submittals.
   a. Sequence of Operation: The sequence of operation included in the design documents is intended only to communicate the Engineers’ general control intent and is not to be used as a direct reference for programming of the EMS system. Verbatim duplication of the Engineer’s Sequence of Operation on the submittals is discouraged and may result in non-approval of the submittal. Sequence of operation on submittals to accurately detail the system’s intended programming, and include details of enhancements, adjustments, or deviations from the Engineer’s sequence of operation. Submitted sequence of operation to be written with a logical and organized format and flow. Provide detailed, clear and unambiguous sequence of operation language. Point descriptors and point nomenclature referenced in the submitted sequence of operation to match those (to be) actually programmed. As-built submittal Sequence of Operation to include modifications to the programming made as a result of any addendum, bulletins, RFI’s, change orders, and commissioning.

4. Format: Make each submittal in one complete and contiguous package. Partial or unmarked submittals will be rejected without review.

5. Submit Manufacturers Data as Follows:
   a. Complete materials list of items proposed to be furnished and installed. A complete Bill of Materials, listing materials, components, devices, wire and equipment are required for this work. The Bill of Materials to be separate for each controller on its own page(s) and to contain the following information for each item listed:
      1) Manufacturer's Name and Model number with furnished options highlighted.
      2) Quantity of each by controller location.
      3) Description of product (generic).
      4) Specified item.
      5) Operating range or span.
      6) Operating point or setpoint.
   b. Manufacturer's specifications and other data required demonstrating compliance with the specified requirements, including but not limited to: Catalog cuts, technical data and descriptive literature on hardware, software, and system components to be furnished.
   c. The data to be clearly marked and noted to identify specific ranges, model numbers, sizes, and other pertinent data. Submit printed manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials and including printed installation instructions and start-up instructions.
d. Unless specifically called for otherwise, provide bound copies of catalog cuts for standard products, not requiring specifically prepared Shop Drawings, for the following:
   1) Wire and Cable, Class II
   2) Face Plates for Devices
   3) Disconnect Switches for Power Control

e. Where more than one item, size, rating or other variations appear on a catalog cut sheet, clearly identify items to be provided. These items to be properly indexed and referenced to identification numbers, designations and/or details on the Drawings.

6. Shop Drawings: Submit shop drawings for each controlled system, depicting the following information:
   a. Schematic flow diagram of system showing fans, pumps, coils, dampers, valves and other control/monitoring devices.
   b. Label each control device with initial setting or adjustable range of control. Label points in schematic diagrams with termination at corresponding controller.
   c. Electrical Wiring: Clearly differentiate between portions of wiring that are factory installed and portions of be field-installed.
   d. Details of control panel faces, including controls, instruments, and labeling.
   e. Interfaces to equipment furnished under other Specification Sections identifying numbers of wires, termination location, voltages and pertinent details. Responsibility for each end of the interfaces to be noted on these drawings whether or not they are a part of this Section.
   f. System architecture diagram showing the global connectivity of new controllers and any existing systems that will be connected to.

7. Equipment locations, wiring and piping schematics, details, panel configurations, sizes, damper motor mounting details, valve schedules, and a points list keyed to specific hardware submittals. Control wiring depicted as fully annotated ladder diagrams with terminations identified, completely configured as to the exact panel, wiring, relay, switch, and component configuration.

8. Tag Number Lists: Develop instruments tag number system and submit list for approval. Coordinate methods and number block with the Owner Representative.

9. Format the Shop and Field Drawings to Include:
   a. A Title Sheet containing a drawing list, abbreviations list, symbols list, site and vicinity maps for project location and schedules.
   b. Floor Plans showing proposed device locations and device nomenclatures.
   c. A Riser Diagram illustrating conduit relationships between devices shown on the Floor Plans. Show device nomenclatures.
   d. A Single-Line Diagram for each system showing signal relationships of devices within the system. Show device nomenclatures.
   e. A Wiring Diagram for each assembly, enclosure or free standing device, showing:
      1) The Devices Within
      2) Wiring Connections
      3) Wire Identification
      4) Voltage Levels
      5) Fuse Ratings
   f. Operations and Maintenance Manuals:
1) Following approval of Shop Drawings of control equipment and prior to acceptance of control work, prepare Operating and Maintenance manuals describing operating, servicing, and maintenance requirements of control systems and equipment installed under this Section, in accordance the General and Special Conditions of these Specifications.

2) Information contained in the manual for the above equipment to include the following:
   a) Manufacturer's catalog cuts and printed descriptive bulletins.
   b) Manufacturer's installation, operating, and maintenance instruction booklets. Complete instructions regarding the operation and maintenance of equipment involved.
   c) Instrument calibration certificates.
   d) Parts list and costs.
   e) Complete nomenclature of replaceable parts, list of recommended spare parts for 12 months operation, their part numbers, current cost and name and address of the nearest vendor of replacement parts.
   f) Name, address and telephone number for closest source of spare parts.
   g) Wiring and schematic diagrams.
   h) Include final record copies of shop drawings.
   i) Copy of guarantees and warranties issued for the various items of equipment, showing dates of expiration.
   j) Reduced plans, diagrams, and control schematics.
   k) Copies of test results.
   l) Control System Operating Manual including: point of summary and point data base; complete printout of program listings; magnetic tape CD or DVD backup of Field Control Cabinet programs; cabinet layout; hard copy of graphic screens; hard copy of specified reports.
   g. A final Bill of Quantities including a separate schedule for portable equipment, if delivered as part of this work.
   h. Performance, Test and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified in these specifications.
   i. Record Drawings: Comply with Section 01780, Project Record Documents, and Section 23 00 00, HVAC Basic Requirements. Provide complete as-built submittals including "as-programmed" sequence of operation as well as final occupancy schedules.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Installer Qualifications: Company specializing in performing work of the type specified in this Section with minimum five years' experience in the local area. Installers required to have successfully completed manufacturer's control system factory training.
1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 SYSTEM DESCRIPTION

A. Control system referenced throughout specifications and drawings as Building Automation System (BAS), Building Management System (BMS), or Energy Management System (EMS) interchangeably consists of high-speed, peer-to-peer network of DDC controllers, control system server, and operator workstation. System to be UUKL listed if used for smoke control.

B. System software based on server/thin-client architecture, designed around open standards of web technology. Control system server accessed using a web browser over control system network, Owner's local area network, and remotely over Internet (through Owner's LAN). Intent of thin-client architecture is to provide operators complete access to control system via web browser. No special software other than web browser required to access graphics, point displays, and trends.

C. Local Area Network (LAN) either 10 or 100 Mpbs Ethernet network.

D. System will consist of open architecture that is capable of:
   1. High speed Ethernet communication using TCP/IP protocol.
   2. Native BACnet communications according to ANSI / ASHRAE Standard 135, latest edition. Provide necessary BACnet-compliant hardware and software to meet the system's functional specifications. Controller devices must be BTL tested and listed by an official BACnet Testing Laboratory and have the BTL mark issued.

E. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation valves and dampers.

F. Prepare individual hardware layouts, interconnection drawings, building riser/architecture diagram and sequence of control from the project design data. Any architecture diagrams on design drawings have been included as schematics only and are not meant to portray quantity of devices or power/data requirements.

G. Design, provide, and install equipment cabinets, panels, data communication network infrastructure (including cables, conduits, outlets, connections, etc.) needed, and associated hardware.

H. Provide complete manufacturer's specifications for items that are supplied. Include vendor name and model number of every item supplied.

I. Provide a comprehensive operator and technician training program as described in these Specifications.

J. Provide as-built documentation, operator's terminal software, diagrams, and other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
K. Provide 120V power, low voltage power, transformers, etc. for control panels, transformer panels, and BAS devices. Install per Division 26, Electrical Specifications. Power for devices within this Specification Section is solely the responsibility of the BAS Contractor.

L. Conduit and raceway systems. Provide per Division 26, Electrical Specifications.

M. Devices, components, controllers, and software to be manufacturer's most current version at the time of installation.

1.8 SYSTEM PERFORMANCE

A. Performance Standards - System conforms to following minimum standards over network connections:
   1. Graphic Display: Graphic with 20 dynamic points display with current data within 10 seconds.
   2. Graphic Refresh: Graphic with 20 dynamic points update with current data within 8 seconds.
   3. Object Command: Devices react to command of binary object within 2 seconds. Devices begin reacting to command of analog object within 2 seconds.
   4. Object Scan: Data used or displayed at controller or workstation have been current within previous 6 seconds.
   5. Alarm Response Time: Object that goes into alarm is annunciated at workstation within 45 seconds.
   6. Program Execution Frequency: Custom and standard applications are capable of running as often as once every 5 seconds. Select execution times consistent with mechanical process under control.
   7. Performance: Programmable controllers are able to completely execute DDC PID control loops at frequency adjustable down to once per second. Select execution times consistent with mechanical process under control.
   8. Multiple Alarm Annunciation: Each workstation on network receive alarms within 5 seconds of other workstations.

B. Reporting Accuracy: System reports values with minimum end-to-end accuracy listed in Reporting Accuracy Table below.
   1. Reporting Accuracy Table:

<table>
<thead>
<tr>
<th>Measure Variable</th>
<th>Reported Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Temperature</td>
<td>Plus or Minus 1 degree F</td>
</tr>
<tr>
<td>Ducted Air</td>
<td>Plus or Minus 1 degrees F</td>
</tr>
<tr>
<td>Outside Air</td>
<td>Plus or Minus 2 degrees F</td>
</tr>
<tr>
<td>Dew Point</td>
<td>Plus or Minus 3 degrees F</td>
</tr>
<tr>
<td>Water Temperature</td>
<td>Plus or Minus 1 degree F</td>
</tr>
<tr>
<td>Delta-T</td>
<td>Plus or Minus 0.25 degree F</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Plus or Minus 5 percent RH</td>
</tr>
<tr>
<td>Water Flow</td>
<td>Plus or Minus 2 percent of full scale</td>
</tr>
</tbody>
</table>

   2. Note 1: Accuracy applies to 10 percent-100 percent of scale
3. Note 2: For both absolute and differential pressure
4. Note 3: Not including utility-supplied meters

C. Control Stability and Accuracy. Control loops maintain measured variable at setpoint within tolerances listed in Control Stability and Accuracy Table below.
1. Control Stability and Accuracy Table:

<table>
<thead>
<tr>
<th>Controlled Variable</th>
<th>Control Accuracy</th>
<th>Range of Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Pressure</td>
<td>Plus or minus 0.2 inch wg</td>
<td>0-6 inch wg</td>
</tr>
<tr>
<td></td>
<td>Plus or minus 0.01 inch wg</td>
<td>-0.1 to 0.1 inch wg</td>
</tr>
<tr>
<td>Airflow</td>
<td>Plus or minus 10 percent of full scale</td>
<td></td>
</tr>
<tr>
<td>Space Temperature</td>
<td>Plus or minus 2.00 degrees F</td>
<td></td>
</tr>
<tr>
<td>Duct Temperature</td>
<td>Plus or minus 3.0 degrees F</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>Plus or minus 5 percent RH</td>
<td></td>
</tr>
<tr>
<td>Fluid Pressure</td>
<td>Plus or minus 1.5 PSI</td>
<td>1-150 PSI</td>
</tr>
<tr>
<td></td>
<td>Plus or minus 1.0 inch wg</td>
<td>0-50 inch wg differential</td>
</tr>
</tbody>
</table>

PART 2 - PRODUCTS

2.1 NORTHERN CALIFORNIA MANUFACTURERS/INSTALLERS

A. Automated Logic/Sunbelt Controls, Air Systems Inc

B. Andover (Schneider Electric)/Steven Engineering, Alameda Electrical Distributors Inc, Graybar Electric Company Inc, Powermatic Associates

C. Or equal.

D. Duct/Spot-Type Smoke Detectors (Project with Fire Alarm System):
1. See Division 28 for Products.

2.2 COMMUNICATIONS

A. Each controller to have communication port for connection to operator interface.
1. Internetwork operator interface and value passing to be transparent to internetwork architecture.
2. Operator interface connected to controller to allow operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, reports, system software, and custom programs to be viewable and editable from each internetwork controller.

B. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers to be readable by each controller on internetwork.
2.3 CONTROLLER SOFTWARE

A. Furnish following applications software for building and energy management. Software applications reside and operate in system controllers. Software to be manufacturer's most current version at the time of installation. Software and associated functions (scheduling, optimum start/stop, etc.) noted in this specification are to be configured and enabled for this project. Incorporate into sequence of operation submittals for review prior to installation.

B. System Security:
1. User access secured using individual security passwords and user names.
2. Restrict user passwords to objects, applications, and system functions as assigned by system manager. Provide monitoring only access to Engineer of Record and Commissioning Authority for period of one year for trouble shooting purposes.
3. Record user Log On/Log Off attempts.
4. Provide passwords, user names, and access assignments adjustable at the operator's terminal. Each user to have a set security level, which defines access to displays and individual objects the user may control. System to include 10 separate and distinct security levels for assignment to users.
5. System to include an Auto Logout Feature that will automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period to be adjustable by system administrator. Auto Logout may be enabled and disabled by system administrator. Operator terminal to display message on screen that user is logged out after Auto Logout occurs.

C. Scheduling: Provide capability to schedule each object or group of objects in system. Coordinate schedule with Owner and program accordingly. Each schedule consists of:
1. Operator's workstation to show information in easy-to-read daily format. Priority for scheduling: Events, holidays and daily with events being the highest.
2. Holiday and special event schedules to display data in calendar format. Operator able to schedule holidays and special events directly from these calendars.
3. Operator able to change information for a given weekly or exception schedule if logged on with the appropriate security access.

D. Optimum Start/Stop: Provide software and program system to start equipment on sliding schedule based upon indoor and outdoor conditions. Determine minimum time of HVAC system operation needed to satisfy space environmental requirements and also determine earliest possible time to stop mechanical systems (i.e. shut down cooling/heating and only provide ventilation one hour prior to scheduled unoccupied period.) Optimum start/stop program operates in conjunction with scheduled start/stop and night setback programs.

E. Alarms:
1. Operator's workstation to provide visual means of alarm indication. The alarm dialog box to always become the top dialog box regardless of the application(s), currently running.
2. System to provide log of alarm messages. Alarm log to be archived to the hard disk of the system operator's terminal. Each entry to include a description of the event-initiating object generating the alarm. Entry to include time and date of alarm occurrence.
3. Alarm messages in user-definable text and entered either at the operator's terminal or via remote communication.
4. Each binary object set to alarm based on operator-specified state.
5. Each analog object have both high and low alarm limits.
6. Alarms must be able to be automatically and manually disabled.
7. Alarms are routed to appropriate workstations based on time and other conditions. An alarm is able to start programs, print, be logged in event log, generate custom messages, and display graphics.
8. System have ability to dial out in event of alarm.
9. Alarm Levels:
   a. Provide 5 levels of alarm as follows, and program alarm levels for every required and specified alarm:
      1) Level 1: Critical/life safety.
      2) Level 2: Significant equipment failure.
      3) Level 3: Non-critical equipment failure/operation.
      4) Level 4: Energy conservation monitor.
      5) Level 5: Maintenance indication, notification.
   b. Prior to training of Owner's representative, submit the complete Points List and suggested Alarm Levels to the Owner.
   c. During training of Owner's representative(s):
      1) Discuss Alarm Levels and the alarms currently included in the BAS.
      2) Provide additional alarms without addition of new hardware points, as required by Owner's Representative.
      3) Agree with the Owner's Representative on action(s) to be taken for each alarm level and implement same for each alarm. Said action to include visual and/or audible alarm(s) at the Operator workstation including whether Operator acknowledgement is required or not, email messages, and text messages.

F. Demand Limiting:
1. System to include demand limiting program that includes two types of load shedding. One type of load shedding to shed/restore equipment in binary fashion based on energy usage when compared to shed and restore settings. The other type of shedding to adjust operator selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connected to system.
2. Status of each and every load shed program capable of being displayed on every operator terminal connected to system. Status of each load assigned to an individual shed program displayed along with the description of each load.
3. Demand-limiting program monitor building power consumption from signals generated by pulse generator (provided by BAS contractor) mounted at building power meter or from watt transducer or current transformer attached to building feeder lines.
4. Demand-limiting program predicts probable power demand so that when demand exceeds demand limit, action will be taken to reduce loads in predetermined manner. When demand limit will not be exceeded, action will be taken to restore loads in predetermined manner.
G. Maintenance Management: System monitors equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits. Coordinate settings with Owner.

H. Sequencing: Provide application software based upon sequences of operation specified to properly sequence designated systems. Provide points to achieve specified sequences.

I. Staggered Start: This application prevents controlled equipment from simultaneously restarting after a power outage. Order in which equipment (or groups of equipment) is started, along with time delay between starts to be user-selectable.

J. Energy Calculations: Provide software to allow instantaneous power (e.g. kW) or flow rates (e.g. L/s (gpm)) to be accumulated and converted to energy usage data.

K. Anti-Short Cycling: Binary output objects protected from short cycling by allowing minimum on-time and off-time to be selected.

L. On/Off Control with Differential: Provide algorithm that allows binary output to be cycled based on controlled variable and setpoint. Algorithm direct-acting or reverse-acting and incorporate adjustable differential.

M. Run-Time Totalization: Provide software to totalize run-times for binary input objects.

2.4 WEB BASED ACCESS

A. General Description: BAS supplier to provide web-based access to the system as part of standard installation. Provide access to user of displays of real-time data that are part of the BAS via a standard Web browser. Web browser to tie into the network via Ethernet network connection. Provide web-page host that resides on the BAS network. Web-page software not to require a per user licensing fee or annual fees. The web-page host must be able to support at least 50 simultaneous users with the ability to expand the system to accommodate an unlimited number of users. Software to be manufacturer's most current version at time of installation.

B. Browser Technology: Browser to be standard version of Microsoft Internet Explorer (latest edition). No special vendor-supplied software needed on computers running browser. Displays viewable and the Web-page host to directly access real-time data from the BAS network. Data displayed in real time and update automatically without user interaction. User able to change data on displays if logged in with the appropriate user name and password.

C. Display of Data: Web page graphics shown on browser to be replicas of the BAS displays. User to need no additional training to understand information presented on Web pages when compared to what is shown on BAS displays. Web page displays to include animation just as BAS displays. Fans to turn, pilot lights to blink, and coils to change colors, and so on. Real-time data shown on browser Web pages. This data must be directly gathered via the BACnet network and automatically updated on browser Web page displays without any user action. Data on the browser to automatically refresh as changes are detected without re-drawing the complete display. User to be able to change data from browser Web page to if the user is logged on with the appropriate password. Clicking on a button or typing in a new
value to change digital data. Using pull-down menus or typing in a new value to change analog data. Data displays navigated using pushbuttons on the displays that are simply clicked on with the mouse to select a new display. Alternatively, the standard back and forward buttons of the browser can be used for display navigation.

D. Web Page Generation: Web pages generated automatically from the BAS displays that reside on the BAS server. User to access Web-page host via the network and initiate a web page generation utility that automatically takes the BAS displays and turns them into Web pages. The Web pages generated are automatically installed on the Web page host for access via any computer's standard browser. Any system that requires use of an HTML editor for generation of Web pages will not be considered.

E. Password Security and Activity Log: Access via Web browser to utilize the same hierarchical security scheme as BAS system. User asked to log in once the browser makes connection to Web-page host. Once the user logs in, any changes that are made to be tracked by the BAS system. User able to change only those items that the user has authority to change. A user activity report to show any activity of the users that have logged in to the system regardless of whether those changes were made using a browser or via the BAS workstation.

F. Communication: Web-page host to communicate using the specified protocol standard to devices on the BAS network.

2.5 BAS GRAPHICS

A. Develop customized graphics showing the project building(s) and their floor plans, mechanical, and electrical equipment, flow and control diagrams, and other relevant features on Workstation graphic screens. Associated input, output, and virtual objects (e.g., temperature and pressure setpoints) listed in the Sequence of Operation, and shown on the Input/Output Objects List included in the graphic screens and bound to the database. Real-time value of objects updated on the display of each graphic automatically. For projects where existing campus and/or building controls systems exist, replicate graphics used in the existing BAS graphics screens.

B. Graphics to have links to the Print function and to display a Standard Legend in the corner of the graphic. Graphics, except pop-ups, to have the date and time displayed in the upper corner of the graphic. Each graphic titled.

C. Weather: Graphics, except pop-ups, to have the outdoor temperature and humidity in the upper corner of the graphic.

D. Alarms: System and component summary alarms located near the top of each relevant graphic screen. Provide links to the associated system/component as part of these tags to assist trouble shooting. Other alarms placed near the associated system/device as depicted in the graphic. Provide text and color of information tags that describe each object and alarm value consistent with a graphics color legend.

E. The Following Graphics Provided as a Minimum:
   1. A building graphic, typically a photograph of the building, with links to each floor plan and other links as defined below.
2. A central plant graphic with equipment (chillers, boilers, pumps, heat exchangers, storage tanks, etc.), temperature sensors, pressure sensors, flow sensors and refrigeration leak detectors. The central plant graphic to have links to each building on the campus.

3. Central equipment such as air handler, package rooftop equipment, supply fans, exhaust fans, and smoke control systems.

4. Floor plans of each floor, with temperature sensors, pressure sensors, temperature control zones, heating/cooling zones, ventilation zones, and supply air zones identified. Rooms grouped on a graphic only to the extent that detailed and complete sensing information can be comfortably viewed by an operator and the bound points updated in less than 10 seconds. Each zone to have a temperature symbol that changes color over the range from low (blue) through normal (green) to high (red) and indicate an alarm (flashing red). The zone temperature and or pressure symbol(s) to be a link to a zone control pop-up graphic. Individual floor plan graphics to provide links to related mechanical systems. The mechanical room plan graphics to show the relative location of, and provide links to, either the equipment pop-up or flow and control graphic for mechanical equipment monitored or controlled by the BAS.

5. Pop-up graphics provided for each zone control system showing a flow diagram and related monitoring and control points and system parameters. Pop-up graphics provided for each piece of equipment that is not shown on a flow and control graphic.

6. Flow and control diagrams for each system including but not limited to central plant, fan coils, generators, packaged equipment, chilled water systems, heating hot water systems, heat exchangers, pumps, storage tanks, zone terminal units, isolation room systems, smoke damper status, combination fire and smoke damper status, and ventilation systems. The flow and control graphics to have parameters grouped in the lower portion of the graphics. Standard equipment graphics used. Pumps, fans, dampers and other elements to dynamically indicate their state (i.e. pumps and fans to rotate when on and damper positions to dynamically adjust and be shown in their current position, etc.). System flow and control graphics displayed in a general left to right flow or loop arrangement. Return and exhaust air flow shown on top and return water shown on the bottom of the graphic.

7. Individual equipment/component screens showing sensing and control information available for each device provided.

F. Penetration: The graphic interface to consistently apply a convention whereby a left-click to always penetrate to more detailed information. The text windows to represent the deepest level of penetration. A right-click to always produce a menu of options that are specific to the item selected.

G. Navigation: Graphics organized to provide a "branching structure" that allows an operator to move from a "macro view" to a "micro view" and return. These links to other associated graphics, or allow a return to a previous macro view, provided and arranged horizontally along the bottom of each graphic screen. From left to right, the graphic links as follows: site/building map, building/trailer floor plans, and major mechanical systems at each building. Pop-up right click menus provided as needed on the lower button bar to allow for uncluttered navigation.

H. Clutter Minimization: Each graphic to have separate check boxes in the lower right corner that show/hide setpoints, alarms/safeties, and devices/equipment.
I. Templates: To the maximum extent possible, use standard graphics as templates to provide a consistent look throughout the interface.

J. Color Scheme: The graphics to use dynamic color changes to communicate equipment type, or object status consistent with the graphics color legend.

K. Symbols and Animations: Fans, pumps, dampers, coils, and generation equipment to be dynamic symbols indicating rotation, state, or position, movement, flow, etc.

L. Macros: When macros are used to add functionality to the graphics, detailed documentation provided.

M. Configure Mode: Access to “Configure Mode” for editing of the graphics password protected to prevent unauthorized changes to the graphics. This password supplied to the appropriate personnel.

N. Graphics Version: Graphics provided in the most current format available at time of control system programming.

O. Points and graphics checked for the proper binding and graphic programming, settings to ensure that the correct system, location, point values and dynamics are shown in the proper location and rotate in the proper directions.

P. After graphics have been accepted, provide, on a CD ROM in an agreed upon file structure. If the graphics have active-x controls or other files that must be placed outside the graphics folder structure a set-up program provided on the disk to place the files in the correct locations.

2.6 BUILDING CONTROLLERS

A. General: Provide adequate number of building controllers to achieve performance specified. Panels to meet the following requirements.

1. Building Automation System (BAS) to be composed of one or more independent, stand-alone, microprocessor-based building controllers to manage global strategies described in Controller Software article.

2. Provide sufficient memory to support operating system, database, and programming requirements.

3. Share data between networked building controllers.

4. Distributed controllers to share real and virtual object information and allow for central monitoring and alarms.

5. Controllers that perform scheduling have real-time clock.

6. Continually check status of its processor and memory circuits and if abnormal operation is detected, controller:
   a. Assume predetermined failure mode.
   b. Generate alarm notification.

7. Building Controller communicates with other devices on internetwork including BACnet communications according to specified protocol.

B. Communication:
1. Each building controller resides on network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and performs routing to network of custom application and application specific controllers.
2. Controller provides a service communication port for connection to a portable operator's terminal.

C. Environment:
1. Controllers used outdoors and/or in wet ambient conditions mounted within NEMA waterproof enclosures and rated for operation at 0 degrees F to 150 degrees F.
2. Controllers used in conditioned space are mounted in NEMA dust-proof enclosures and rated for operation at 32 degrees F to 120 degrees F.

D. Keypad: Local keypad and display to be provided for each controller. Security password to be available to prevent unauthorized use of keypad and display.

E. Serviceability: Provide diagnostic LEDs for power, communication, and processor. Wiring connections are made to modular terminal strips or to termination card connected by ribbon cable.

F. Memory: Building controller maintains BIOS and programming information in event of power loss for at least 72 hours.

G. Immunity to power and noise. Controller able to operate at 90 percent to 110 percent of nominal voltage rating and performs an orderly shutdown below 80 percent nominal voltage. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3-feet.

H. Controller to have a battery to provide power for orderly shutdown of controller and storage of data in nonvolatile flash memory. Battery backup to maintain real-time clock functions for a minimum of 10 days.

2.7 APPLICATION SPECIFIC CONTROLLERS

A. Application specific controllers (ASCs) are microprocessor-based DDC controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. Controllers to be fully programmable using graphical programming blocks.
1. ASC controllers communicate with other devices on internetwork.
2. Each ASC capable of stand-alone operation without being connected to network.
3. Each ASC will contain sufficient I/O capacity to control target system.
4. Application controllers to include universal inputs with minimum 10-bit resolution that accept thermistors, 0-10VDC, 0-5 VDC, 4-20 mA and dry contact signals. Any input on a controller may be either analog or digital with at least 1 input that accepts pulses. Controller to also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller to include binary and analog outputs on board. Provide analog outputs switch selectable as either 0-10VDC or 0-20mA. Software to include scaling features for analog outputs. Application controller to include 24VDC voltage supply for use as power supply to external sensors.
5. Program sequences stored on board application controller in EEPROM. No batteries needed to retain logic program. Program sequences executed by controller 10 times per
second and capable of multiple PI and PID loops for control of multiple devices. Calculations completed using floating-point math and system to support display of information in floating-point nomenclature at operator's terminal. Programming of application controller completely modifiable in the field over installed BAS LANs or remotely via modem interface. Operator to program logic sequences by graphically moving function blocks on screen and tying blocks together on screen.

6. Application controller to include support for room sensor. Display on room sensor programmable at application controller and include an operating mode and a field service mode. Provide button functions and display data programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

B. Communication:
   1. Controller resides on network using MS/TP Data Link/Physical layer protocol.
   2. Each controller connected to building controller.
   3. Each controller capable of connection to laptop computer or portable operator's tool.

C. Environment:
   1. Controllers used outdoors and/or in wet ambient conditions mounted within NEMA waterproof enclosures and rated for operation at 0 degrees F to 150 degrees F.
   2. Controllers used in conditioned space mounted in NEMA dust-proof enclosures and rated for operation at 32 degrees F to 120 degrees F.

D. Serviceability: Provide diagnostic LEDs for power, communication, and processor.

E. Memory: ASC use nonvolatile memory and maintains BIOS and programming information in event of power loss.

2.8 APPLICATION SPECIFIC CONTROLLER - TERMINAL UNIT CONTROLLERS

A. Provide one application controller for each terminal unit that adequately covers objects listed in object list for unit. Controllers to interface to building controller via LAN using specified protocol. Controllers to include on board flow sensor, inputs, outputs and programmable, self-contained logic program as needed for control of units.

B. Application controllers to include universal inputs with 10-bit resolution that can accept thermistors, 0-5 VDC, and dry contact signals. Inputs on controller may be either analog or digital. Controller to also include support and modifiable programming for interface to intelligent room sensor with digital display (digital display to indicate setpoint only). Controller to also include binary outputs on board. For applications using variable speed parallel fans, provide a single analog output selectable for 0-10 V or 0-20 mA control signals. Application controller to include microprocessor driven flow sensor for use in pressure independent control logic. Terminal units controlled using pressure independent control algorithms and flow readings to be in CFM.

C. Program sequences stored on board application controller in EEPROM. No batteries needed to retain logic program. Program sequences executed by controller 10 times per second and capable of multiple PI loops for control of multiple devices. Provide programming of application controller completely modifiable in the field over installed specified protocol.
LANs or remotely via modem interface. Operator to program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller programmed using the same programming tool as Building Controller and as described in Operator Workstation article.

D. Application controller to include support for intelligent room sensor. Display on room sensor programmable at application controller and include an operating mode and a field service mode. Button functions and display data programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence for specific display requirements for intelligent room sensor.

E. Provide duct temperature sensor at discharge of each terminal unit that is connected to controller for reporting back to operator workstation. Provide analog inputs for the duct temperatures.

2.9 INPUT/OUTPUT INTERFACE

A. Input/output points protected such that shorting of point to itself, to another point, or to ground will cause no damage to controller. Input and output points protected from voltage up to 24 V.

B. Binary inputs (BI or DI) allow monitoring of On/Off signals from remote devices. Binary inputs sense “dry contact” closure without external power (other than that provided by controller) being applied.

C. Pulse accumulation input objects accept up to 10 pulses per second for pulse accumulation.

D. Analog inputs (AI) allow monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD).

E. Binary outputs (BO or DO) provide for On/Off operation or pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers have three-position (On/Off/Auto) override switches and status lights. Outputs selectable for either normally open or normally closed operation.

F. Analog outputs (AO) provide a modulating signal for control of end devices. Outputs provide either a 0 to 10 VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs on building controllers have status lights and two-position (AUTO/MANUAL) switch and adjustable potentiometer for manual override. Analog outputs not exhibit drift of greater than 0.4 percent of range per year.

G. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms run zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
2.10 POWER SUPPLIES AND LINE FILTERING

A. Control transformers UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits. Limit connected loads to 80 percent of rated capacity.

B. DC power supply output match output current and voltage requirements. Unit operates between 32 degrees F and 120 degrees F.

C. Line voltage units UL listed and CSA approved.

D. Power line filtering. Provide transient voltage and surge suppression for workstations and controllers.

2.11 CONTROL PANELS

A. Control Panels:
   1. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures to be NEMA 12 when installed in other than a clean environment. Outdoor enclosures must be NEMA 3R. Provide (hinged door) key-lock latch and removable subpanels. Single key common to field panels and subpanels. In existing campus or building settings, key lock to match existing keys.
   2. Interconnections between internal and face-mounted devices prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections UL listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection individually identified per control drawings.
   3. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.
   4. Provide laminated plastic nameplates for enclosures in any mechanical room or electrical room labeled with TCP number. Laminated plastic to be 1/8-inch thick sized appropriately to make label easy to read.

2.12 AUXILIARY CONTROL DEVICES

A. Temperature Instruments:
   1. Low-voltage or Line-voltage Thermostats: Bimetal-actuated, snap acting SPDT contact, enclosed, UL listed for electrical rating, exposed setpoint adjustment on cover with heat anticipator. Thermostat operates within 55 degrees F to 85 degrees F setpoint range, with 2 degrees F maximum differential.
   2. Room Temperature Sensors: Thermistor or platinum RTD type with accuracy of plus or minus 0.5 degrees F at 70 degrees F; operating range 30-120 degrees F; linear signal; single point sensing element in wall-mounted ventilated enclosure with insulating back plate if mounted on exterior wall; plug-in portable operators terminal port.
   3. Room Temperature Sensor: Thermistor or platinum RTD type with accuracy of plus or minus 0.5 degrees F at 70 degrees F; operating range 30-120 degrees F; linear signal; single point sensing element in wall-mounted ventilated enclosure with insulating back plate if mounted on exterior wall; push button for occupancy override; digital setpoint...
adjustment plus or minus 2 degrees F in both directions; LCD temperature display indicating setpoint only. Setpoint adjustment to revert to building programmed standard temperature upon next building occupancy schedule change (user adjustable). Room temperature sensor may have integral space carbon dioxide sensor with minimum performance characteristics identified within this specification. Include integral occupancy sensor for public rooms but not in offices.

4. Averaging Duct Temperature Sensors: Thermistor or platinum RTD element with accuracy of plus or minus 0.5 degrees F at 32 degrees F, consisting of array of single point sensing elements, securely mounted in duct or plenum; operating range 20-120 degrees F; linear signal; 1-foot element per 2 SF of duct cross-sectional area. Use when duct is 9 SF or larger or where air is subject to temperature stratification.

5. Probe Duct Temperature Sensors: Thermistor or platinum RTD element with accuracy of plus or minus 0.5 degrees F at 32 degrees F, consisting of single point sensing elements, securely mounted in duct or plenum; operating range 20-120 degrees F; linear signal; 24-inch rigid probe. Use where duct is less than 9 SF cross-sectional area.

6. Outside Air Temperature Sensor: Thermistor or platinum RTD element with accuracy of plus or minus 0.5 degrees F at 32 degrees F; Range -58 to 120 degrees F, single element, linear, with weather and sun shield for exterior mounting.

7. Low Temperature Limit Thermostat: Minimum 20 foot capillary sensing element, triggering on low temperature as sensed by any 12-inch segment; snap acting, normally open contacts, manual reset, line voltage.

8. Liquid Immersion Temperature Sensor: Thermistor or platinum RTD element, with accuracy of plus or minus 0.5 degrees F at 32 degrees F, stainless steel well and assembly, range 30 to 250 degrees F.

9. Pneumatic Room Thermostat: Two-pipe relay type with concealed adjustment, and no thermometer, blank cover secured with Allen screws.

B. Humidity Sensors:
   1. Space Humidity Sensors: Operating range 10 to 95 percent relative humidity, accuracy plus or minus percent RH, surface mounted ventilated enclosure for wall mounting.
   2. Duct Humidity Transmitter: Capacitive type sensor and transmitter, linear output signal; automatic temperature compensating; air filter; plus or minus 2 percent RH accuracy from 0 to 100 percent RH.
   3. Humidity sensor's drift not exceed 1 percent of full scale per year.

C. Pressure Transmitters and Transducers:
   1. Transducer have linear output signal; field adjustable zero and span. Sensing elements withstand continuous operating conditions of positive or negative pressure 50 percent greater than calibrated span without damage.
   2. Differential Pressure Switch: Setpoint adjustable with operating range of 0.5 to 12-inch WG for fans, and 5 to 30-feet WC for pumps. Switches UL listed; SPDT snap-acting; pilot duty rated (125 VA minimum); NEMA 1 enclosure; scale range and differential suitable for intended application.
   3. Filter Differential Pressure Switch: Setpoint adjustable with operating range of 0.1 to 5-inch WG; auto reset. Contactor to close when pressure differential setting is met or exceeded. Provide mounting bracket, metallic tubing and appropriate fittings for connection to duct or air-handling unit.
4. Duct Static Differential Pressure Transducer: Operating range 0 to 5-inch WC for duct mounted transmitter; ceramic capacitive sensing element with probe securely mounted in duct; digital input terminal and push button to zero output. Accuracy plus or minus 1 percent of full scale; maximum response time 2 seconds.

5. Building Static Pressure Transducer: Operating range of -0.1 to 0.1-inch WC, linear signal. Sensing tubes located inside and outside building use shielding and/or surge tanks to minimize effects of wind. Accuracy plus or minus 1 percent of full scale.

6. Piping Pressure Transmitter: Operating range 0 to 50 PSIG, linear signal; stainless steel diaphragm; digital input terminal and push button to zero output. Accuracy plus or minus 1 percent of full scale.

D. Motorized Control Dampers:
   1. Performance: Maximum leakage of 3 CFM/SF at 1-inch WG differential pressure, AMCA Class 1A, maximum pressure rating of 13-inch WG differential pressure, maximum velocity of 6,000 fpm, -72 degrees F to 275 degrees F temperature rating.
   2. Multi-blade type, except where either dimension is less than 10-inch single blade may be used. Maximum blade length to be 48-inch.
   3. Provide parallel blades for modulating mixing service and opposed blades for throttling service.
   4. Blades to be interlocking; minimum 16 gauge galvanized steel; compression type edge seals and side seating stops. In copper, aluminum and stainless steel duct work, damper material matches duct work material.
   5. Damper blades are reinforced, have continuous full length axle shafts, axle to axle linkage, and/or operating “jackshafts” as required to provide coordinated tracking of blades.
   7. Dampers over 25 SF in area to be in two or more sections, with interconnected blades.
   8. Provide remote damper blade position status with binary input.
   9. Tested in accordance with AMCA Standard No. 500.

E. Motorized Control Valves:
   1. Body pressure rating and connection type construction conforms to pipe, fitting and valve schedules.
   2. Fluid valve close-off ratings and spring ranges operate at maximum flows and maximum available pump heads scheduled without leakage.
   3. Screwed ends except 2-1/2-inch and larger valves with flanged ends.
   4. Steam valve close-off ratings operates at 150 percent of steam pressure without leakage.
   5. Motorized Control Valves (Pressure Independent Control Valves):
      a. Description: Valve consists of pressure compensating cartridge, actuated ball or Y pattern globe valve, and multiple pressure/temperature test ports in a single valve housing.
      b. Construction: Rated for no less than 125 PSI and 250 degrees F. 2-inch and Smaller: brass with threaded connections. 2-1/2-inch and larger: cast iron with flanged connections.
      c. Performance: Flow rate controlled linearly to within 5 percent of target flow rate, for any actuator position (0 to 100 percent), over an operating differential pressure range of 6 to 50 PSI across the valve. Provide valve with integral test ports to verify pressure differential.
d. Manufacturers: Belimo, Danfoss, Flow Control Industries, Griswold, Tour and Andersson or equal.

6. Fluid three-way valves globe valves with linear plug with composition disc for tight shutoff.

7. Pressure drop equal to twice pressure drop through heat exchanger (load), 50 percent of pressure difference between supply and return mains, or 5 PSI, whichever is greater, except two-position valves to be line size.

8. Bubble-tight line size butterfly valves acceptable on 2-1/2-inch lines and above for two-position action only; cast iron body; aluminum bronze disc; EPDM seat, 200 PSI wg.

9. For modulating service that require valve sizes above 6-inch, butterfly or v-port ball valves are allowed.

10. Steam Valves: Body and trim materials in accordance with manufacturer's recommendations for design conditions and service with linear ports for modulating service. Sizing Criteria:
   a. Two-Position Service: Pressure drop 10 percent to 20 percent of inlet PSIG.
   b. Modulating Service: 15 PSIG or less; pressure drop 80 percent of inlet PSIG.
   c. Modulating Service: 16 to 50 PSIG; pressure drop 50 percent of inlet PSIG.
   d. Modulating Service: Over 50 PSIG; pressure drop as scheduled on Drawings.

F. Electric Damper/Valve Actuators:
   1. Provide mechanical or electronic stall protection for each actuator.
   2. Where indicated provide internal mechanical, spring-return mechanism or provide uninterruptible power supply (UPS). Non-spring-return actuators have external manual gear release to position damper/valve when actuator is not powered.
   3. Proportional actuators accepts 0 to 10 VDC or 0 to 20 mA control signal and provide 2 to 10 VDC or 4 to 20 mA operating range.
   4. Actuator sized for torque required plus 25 percent; UL or CSA listed; electronic current overload protection.
   5. VAV Actuators: Actuators proportional 24 VAC actuators using a 4 to 20 mA range of control signals; stops automatically at end of travel; include permanently lubricated gear train.
   6. Actuators for emergency generator damper control rated for 350 degree F. maximum operating temperature and capable to drive fully open and close within 15 seconds.

G. Air Flow Meters:
   1. Fan Inlet Type: Self-supporting aluminum traverse probes housing thermal dispersion sensors. Probe spacing and sensor quantity as recommended by manufacturer. Provide factory calibrated electronic flow transmitter with CFM readout display and capability of providing 4 to 20 milliamp output for interface with direct digital controls. Ebtron GTx116-PC.
   2. Fan Inlet Type: Self-supporting traverse probe type velocity pressure averaging station; stainless steel construction for exhaust fans; aluminum construction for air handler units. Provide factory calibrated electronic flow transmitter; CFM readout display; capable of providing 4 to 20 milliamp output. Air Monitor Volu-probe/FI; Paragon; Accutrol.
transmitter with CFM readout display and capable of 4-20 mA output signal. Ebtron GTA116-PC.

H. Water Flow Meter:
1. Provide a Turbine Flow Meter (reference 23 05 19) complete with installation hardware necessary to enable insertion and removal of the meter without system shutdown. The flow meter hand-insertable up to 400 PSI. The flow meter to have two contra-rotating axial turbines, with electronic impedance-based sensing and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion. Wetted metal components nickel-plated brass. Provide 316L SS construction for hot water applications operating over 250 degrees F, and for any application in non-metallic pipe. The maximum operating temperature 280 degrees F, 300 degrees F peak. Each flow meter individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1 percent and traceable to NIST*. Manufacturer's certificate of calibration provided with each flow meter. Accuracy within plus or minus 0.5 percent of rate at the calibrated velocity, within plus or minus 1 percent of rate over a 10:1 turndown (3.0 to 30 ft/s) and within plus or minus 2 percent of rate over a 50:1 turndown (from 0.4 to 20 ft/s). The flow meter to include integral analog output(s), 4-20 mA, 0-10V, or 0-5V. Bi-directional meters to include an isolated contact closure output for direction. Flow meter covered by the manufacturer's two year warranty.

I. Room Pressure Monitor: Active room pressure monitor and alarm which provides local audio alarm and analog and alarm signals to DDC system. Wall mounted panel with LED differential pressure readout; audible and visual alarm; mute button; range of -0.05 to +0.05-inch WC; accurate to 1 percent of full scale; repeatability plus or minus 1.0 percent of full scale per year, alarm delay ability between 0-30 seconds. Provide door switch to deactivate alarm when space door(s) are open. Input status from BAS to deactivate alarm in unoccupied or shutdown modes. Phoenix Controls APM100.

J. Wall Mounted Space Carbon Dioxide Sensor:
1. Sensor to employ non-dispersive infrared technology. (N.D.I.R.)
3. Sensor Accuracy: Less than or equal to 75 ppm over 0-1500 ppm range.
4. Sensor Response Time: Less than 1 minute.
5. Sensor to employ reference channel design for long-term stability.
6. Sensor to have field selectable 0-10VDC, or 4-20mA outputs.
7. Sensor power requirement less than 3W.
8. Sensor Input Voltage: 20 to 30VAC/DC.
9. Sensor Operating Temperature Range: 0 degrees C to 50 degrees C.
10. Sensor to have models for wall mounting or duct mounting.
11. Sensor to provide at least a 1-year factory warranty from date of purchase.
12. Sensor to match cover in color and look to temperature sensor.
13. Sensor to have display.
14. Manufacturers:
   a. Telaire
   b. Vaisala
   c. Veris
K. Occupancy Sensor: Dual technology infrared and ultrasonic sensing device, ceiling or wall mounted, built-in self-adjusting settings, timer settings of 30 seconds to 30 minutes, with manual and automatic modes. Provide multiple devices in parallel when area served is greater than a single device sensing capability. Provide integral power pack, 120 VAC input, 24 VDC output, with manual override switch. Leviton OSC-MOW series.

L. Relays:
   1. Control relays UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage to be suitable for application.
   2. Time delay relays UL listed solid-state plug-in type with adjustable time delay. Delay adjustable plus or minus 200 percent (minimum) from setpoint or as indicated. Contact rating, configuration, and coil voltage to be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

M. Override Timers: Override timers spring-wound line voltage, UL Listed, with contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified. Timer suitable for flush mounting on control panel face and located on local control panels or where shown.

N. Current Transmitters:
   1. AC current transmitters are self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit range compatible with actual applied span of current value, with internal zero and span adjustment and plus or minus 1 percent full-scale accuracy at 500 ohm maximum burden.
   2. Transmitter meets or exceeds ANSI/ISA S50.1 requirements and UL/CSA recognized.
   3. Unit split-core type for clamp-on installation on existing wiring.

O. Current Transformers: AC current transformers UL/CSA recognized and completely encased (except for terminals) in approved plastic material; plus or minus 1 percent accuracy at 5 A full-scale.

P. Voltage Transmitters: AC voltage; self-powered single-loop (two-wire) type; 4 to 20 mA output with zero and span adjustment; UL/CSA recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1. Ranges include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with plus or minus 1 percent full-scale accuracy with 500 ohm maximum burden.

Q. Voltage Transformers: AC voltage transformers UL/CSA recognized, 600 VAC rated; built-in fuse protection; suitable for ambient temperatures of 40 degrees F to 130 degrees F; plus or minus 0.5 percent accuracy at 24 VAC and a 5 VA load.

R. Power Monitors: Selectable rate pulse output for kWh reading; 4-20 mA output for kW reading; N.O. alarm contact; ability to operate with 5.0 amp current inputs or 0-0.33 volt inputs; plus 1.0 percent full-scale true RMS power accuracy; plus 0.5 Hz, voltage input range 120-600 V, and auto range select; NEMA 1 enclosure. Current transformers having a 0.5 percent FS accuracy, 600 VAC isolation voltage with 0-0.33 V output. If 0-5 A current transformers are provided, a three-phase disconnect/shorting switch assembly is required.
S. Emergency Stop Switch: Red, mushroom type, pull out to operate.

T. End Switches: Turret head Type SPDT. Schneider Electric/Square D Class 9007, Type C54B2, or equal.

2.13 WIRING AND RACEWAYS

A. General: Provide copper wiring, plenum cable, and raceways as specified in applicable Sections of Division 26, Electrical.

B. Insulated wire to be copper conductors, UL labeled for 90 degrees C minimum service.

C. Field panels and controllers to be supplied by building emergency power system where systems being monitored or controlled are on emergency power.

D. Run control wiring as follows:
   1. Mechanical Rooms: In conduit.
   2. Exposed in Building Spaces: In conduit.

E. Field and Subfield Panels: Voltage in panels not-to-exceed 120 volts.

F. Motor Control Centers: Responsibility for correct voltage of holding coils and starter wiring in pre-wired motor control centers interfacing with automatic controls is included hereunder.

G. Wiring for BAS systems communications buses two conductor minimum 18 gauge foil-shielded, stranded twisted pair cable rated at 300 VDC or more than 80 degrees C.

2.14 SMOKE DETECTION (FOR PROJECTS WITH A FIRE ALARM SYSTEM)

A. See Division 28 for Products.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Terminal Devices: Remove terminal sensors, actuators and controls as indicated on drawings and as required to accommodate scope of mechanical work shown on drawings and described in specifications. Remove pneumatic piping and cap with hardware as appropriate. Remove wiring and conduit associated with devices. Do not leave any unused abandoned piping or wiring in space.

B. Graphics and Programming: Remove symbols from control system graphics associated with deleted terminal elements. Modify programming code to delete alarms, control loops, etc., associated with deleted terminal devices.
3.2 EXAMINATION
A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.
B. Notify the Owners' representative in writing of conditions detrimental to the proper and timely completion of the work.
C. Do not begin work until unsatisfactory conditions are resolved.

3.3 CONTROL SYSTEM CHECKOUT AND TESTING
A. Testing completed before Owner's representative is notified of system demonstration.
B. Calibrate and prepare for service of instruments, controls, and accessory equipment furnished under this specification.
C. Verify that control wiring is properly connected and free of shorts and ground faults.
D. Enable control systems and verify calibration and operation of input and output devices.
E. Verify that system operation adheres to sequences of operation.
F. Commissioning and Verification: In addition to commissioning requirements specified elsewhere, provide the following commissioning on the HVAC instrumentation and controls system:
   1. Control systems completely commissioned to ensure aspects of the system are operating as intended and at optimum tuning.
   2. Wiring connections verified and traced from field device to panel to ensure proper connections.
   3. Measured values verified by a hand held calibrated device to validate that value indicated by the control system is in fact the actual measured value.
   4. Loops properly tuned to obtain the desired control value. Each loop to be "upset" and put back in control to demonstrate its ability to stabilize quickly.
   5. Provide a final point-by-point report submitted that indicates the date of each verification, the results, and initialed on each page by the person performing the reading.

3.4 ACCEPTANCE TESTING AND TRAINING
A. Site Testing:
   1. Contractor provides personnel, equipment, instrumentation, and supplies necessary to perform testing. Owner or Owner's representative will witness and sign off on acceptance testing.
   2. Contractor demonstrates compliance of completed control system with Contract Documents. Using approved test plan, physical and functional requirements of project demonstrated.
B. Training:
1. General: Contractor conducts training courses for up to three other designated personnel in operation and maintenance of system. Training manuals provided for each trainee, with two additional copies provided for archival at project site. Manuals include detailed description of subject matter for each lesson. Copies of audiovisuals delivered to Owner. Training day is defined as 8 hours of classroom instruction, including two 15-minute breaks and excluding lunch time, Monday through Friday, during normal first shift in effect at training facility. Notification of any planned training given to Owner's representative at least 15 days prior to training.

2. Operator's Training I: First course taught at supplier's facility for period of one training day. Upon completion, each student should be able to perform elementary operations with guidance and describe general hardware architecture and functionality of system.

3. Operator's Training II: Second course taught at project site for a period of one training day after completion of contractor's field testing. Course includes instruction on specific hardware configuration of installed system and specific instructions for operating installed system. Upon completion, each student should be able to start system, operate the system, recover system after failure, and describe specific hardware architecture and operation of system.

4. Operator's Training III: Third course taught at project site for period of one training day no later than six months after completion of the acceptance test. Course will be structured to address specific topics that students need to discuss and to answer questions concerning operation of system. Upon completion, students should be fully proficient in system operation and have no unanswered questions regarding operation of installed system.

3.5 WIRING

A. Provide electrical wiring required to control systems specified in this Section. Control and interlock wiring complies with national, state and local electrical codes and Division 26, Electrical of this specification.

B. Power wiring required for building control panel(s) to be dedicated circuit(s).

C. Verify location of operator work station with Owner prior to installation.

D. NEC Class 1 (line voltage) wiring UL Listed in approved raceway according to NEC and Division 26, Electrical requirements.

E. Low-voltage wiring meets NEC Class 2 requirements. (Low-voltage power circuits subfused when required to meet Class 2 current limit.)

F. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for intended application.

G. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for purpose of interfacing (e.g., relays and transformers).
H. Where Class 2 wiring is run exposed, wiring run parallel along surface or perpendicular to it and tied at 10 foot intervals.

I. Where plenum cables are used without raceway, support from structural members. Do not support cables with ductwork, electrical raceways, piping, or ceiling suspension systems.

J. Make wire-to-device connections at terminal block or terminal strip. Make wire-to-wire connections at terminal block.

K. Maximum allowable voltage for control wiring 24 V. If only higher voltages are available, provide step-down transformers.

L. Wiring installed as continuous lengths, with no splices permitted between termination points.

M. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at penetrations.

N. Include one pull string in each raceway 1-inch or larger.

O. Control and status relays are to be located in designated enclosures. Enclosures include packaged equipment control panels unless they also contain Class 1 starters.

P. Install raceway to maintain a minimum clearance of 6-inches from high-temperature equipment (e.g., steam pipes or flues).

Q. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

R. Install insulated bushings on raceway ends and openings to enclosures. Seal top end of vertical raceways.

S. Flexible metal raceways and liquid-tight, flexible metal raceways not-to-exceed 3-feet in length and be supported at each end. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways to be used.

T. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections joined with couplings. Terminations made with fittings at boxes.

U. Input and output terminations to be labeled at the controller to identify if they are AI, DI, AD, DO, and function (i.e. pump start, OM Sensor).

3.6 COMMUNICATION WIRING

A. Follow manufacturer's installation recommendations for communication cabling.

B. Verify integrity of network following cable installation.
C. Communication wiring unspliced length when that length is commercially available; labeled to indicate origination and destination data.

D. Grounding of coaxial cable in accordance with NEC regulations article on “Communications Circuits, Cable, and Protector Grounding.”

3.7 INSTALLATION OF AUXILIARY CONTROL DEVICES

A. General:
   1. Install sensors and thermostats in accordance with manufacturer's recommendations.
   2. Room sensors and thermostats installed at 48-inches AFF to midline of sensor on concealed junction boxes properly supported by wall framing at the locations shown on the Drawings.
   3. Low-limit sensors used in mixing plenums installed in a serpentine manner horizontally across duct.
   4. Pipe-mounted temperature sensors installed in wells with heat-conducting fluid in thermal wells.
   5. Install outdoor air temperature sensors on north facing wall or screen, complete with sun shield at designated location.

B. Flow Switch: Use correct paddle for pipe diameter. Adjust flow switch in accordance with manufacturer's instructions.

C. Actuators:
   1. General:
      a. Mount and link control damper actuators according to manufacturer's instructions.
      b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
   2. Actuator Mounting for Damper and Valve Arrangements to Comply with the Following:
      a. Damper Actuators: Do not install in the air stream.
      b. Use a weather proof enclosure (clear and see through) if actuators are located outside.
      c. Damper or valve actuator ambient temperature not-to-exceed 122 degrees F through any combination of medium temperature or surrounding air. Provide appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation as necessary. Mount per manufacturer's recommendations.
      d. Actuator cords or conduit to incorporate a drip leg if condensation is possible. Do not allow water to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point to be avoided to prevent water from condensing in conduit and running into actuator.
      e. Damper mounting arrangements to comply with the following:
         1) Furnish and install damper channel supports and sheet metal collars.
         2) Jack shafting of damper sections not allowed.
         3) Multi-section dampers arranged so that each damper section operates individually. Provide one electronic actuator direct shaft mounted per section.
f. Size damper sections based on actuator manufacturers specific recommendations for face velocity, differential pressure and damper type. In general: Damper section not-to-exceed 24 ft-sq. with face velocity 1500 FPM.
g. Multiple section dampers of two or more arranged to allow actuators to be direct shaft mounted on the outside of the duct.
h. Multiple section dampers of three or more sections wide arranged with a 3-sided vertical channel (8-inch wide by 6-inch deep) within the duct or fan housing and between adjacent damper sections. Vertical channel anchored at the top and bottom to the fan housing or building structure for support. Connect sides of each damper frame to the channels. Holes in the channel to allow damper drive blade shafts to pass through channel for direct shaft mounting of actuators. Face open side of channel downstream of the airflow, except for exhaust air dampers.
i. Multiple section dampers to be mounted flush within a wall or housing opening to receive either vertical channel supports as described above or sheet metal standout collars. Sheet metal collars (12-inch minimum) to bring each damper section out of the wall to allow direct shaft mounting of the actuator on the side of the collar.

3. Pneumatic Actuators:
   a. Size pneumatic damper actuator to operate related control damper(s) with sufficient reserve power to provide smooth modulating action or two-position action. Actuator also sized for proper speed of response at velocity and pressure conditions to which control damper is subject.
   b. Pneumatic damper actuators produce sufficient torque to close off against maximum system pressures encountered.
   c. Where two or more pneumatic damper actuators are installed for interrelated operation in unison, provide dampers with positive pilot positioner. Positive pilot positioner directly mounted to pneumatic damper actuator and have pressure gauges for supply input and output pressures.
   d. Total damper area operated by actuator not-to-exceed manufacturer's maximum area rating. Provide at least one actuator for each damper section. Each damper actuator not to power more than 20-feet of damper.
   e. Use line shafting or shaft couplings (jackshifting) in lieu of blade-to-blade linkages or shaft coupling when driving axially aligned damper sections.

D. Control Valve:
   1. Valves installed in accordance with manufacturer's recommendations.
   2. Slip-stem control valves installed so that stem position is not more than 60 degrees from vertical up position. Ball type control valves installed with stem in horizontal position.
   3. Control valves accessible and serviceable.
   4. Install isolation valves so that control valve may be serviced without draining supply/return side piping system. Install unions at connections to screw-type control valves.
   5. Valve Sizing for Water Coil:
      b. Modulating control valve body size may be reduced, at most, two pipe sizes from the line size or not less than 1/2 the pipe size. BAS contractor to size water coil control valves for the application as follows:
1) Booster-heat valves sized not-to-exceed 4-9 PSI differential pressure. Size valve for 50 percent valve authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.

2) Primary valves sized not-to-exceed 5-15 PSI differential pressure. Size valve for 50 percent valve authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.

3) Butterfly valves sized for modulating service at 60 to 70 degree rotation. Design velocity 12-feet per second or less when used with standard EPDM seats.

c. Valve Mounting Arrangements to Comply with the Following:
   1) Provide unions on ports of two-way and three-way valves.
   2) Install three-way equal percentage Characterized Control valves in a mixing configuration with the “A” port piped to the coil.
   3) Install 2-1/2-inch and above, three-way globe valves, as manufactured for mixing or diverting service to the coil.

E. Control Damper:
   1. Dampers installed in accordance with manufacturer's instructions. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
   2. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

F. Air Flow Station: Install where indicated in ductwork and/or equipment with manufacturer's recommended straight ductwork upstream and downstream of air flow station or as shown on drawings, whichever is greater. Where equipment manufacturer's standard airflow measuring station cannot read airflows at required design velocities, provide appropriate air flow measuring station to provide accurate reading throughout system design operations range.

3.8 SMOKE DETECTION (FOR PROJECTS WITH A FIRE ALARM SYSTEM)

A. Smoke detector furnished and powered/wired under Division 28, Electronic Safety and Security. Coordinate with fire alarm equipment supplier. Installation of duct smoke detector housing and sampling tube under Division 23, HVAC.

B. Install smoke detectors in return air systems greater than 2000 CFM.

C. Install smoke detectors at each story prior to connection to return air riser in systems greater than 15,000 CFM and serving more than one story.

3.9 SEQUENCES OF OPERATION AND POINTS LISTS

A. Where local energy code dictates certain sequences (such as night setback, night flush, pressure and temperature reset, terminal unit sequences, etc.), the sequences are not necessarily repeated in the documents. It is not the intent of this specification or documentation to reiterate the energy code. Provide energy code mandated sequences and document in sequence of operations submittals at no additional cost to the Owner. Provide required points to achieve the appropriate sequences.
B. See control diagrams and sequences on drawings in addition to sequences below.

C. Variable Frequency Drives: For a VFD dependent on an external input for its output setting (e.g., the VFD gets “Frequency” as an input), loss of that external input to result in the VFD holding its last value. If the VFD is running its own PID loop and the external input to the VFD is a setpoint (e.g. duct static pressure setpoint), the VFD to hold the last setpoint. If the VFD loses its process variable (e.g. duct static pressure), the VFD to go to its minimum speed setting.

D. Except as specified otherwise, throttling ranges, proportional bands, and cycle differentials to be centered on the associated setpoint. Modulating feedback control loops to include the capability of having proportional, integral, and derivative action. Unless the loop is specified “proportional only” or “P+I”, Contractor to apply appropriate elements of integral and derivative gain to each control loop to result in stable operation, minimum settling time and maintain the primary variable within the specified maximum allowable variance.

E. Provide a real time clock and schedule controller with sufficient scheduling capability to schedule required controllers and sequences. Schedule functionality may reside in a controller. If a controller is used, document scheduling functionality including names and types on controller points list submittal. Set up initial schedules in coordination with Owner.

F. Scheduling Terminology: When air handlers are scheduled throughout the day, the following defines the terminology used:

1. Occupied Period: Period of time when the building is in use and occupied. Confirm schedule with Owner. Exclude all national holidays. Generally systems will be fully operational throughout this period and ventilation air to be continuously introduced. Space temperature setpoints will generally be in the “normal” range of 68 degrees to 78 degrees F.

2. Unoccupied period: Period of time when the building or zone is not in use and unoccupied. Ventilation air not to be introduced.

3. Preoccupancy Period: Time prior to the Occupied period when the systems are returning the space temperatures from setback to “normal” or occupied setpoints (warm-up and cool-down). Ventilation air shall not be introduced unless outside air conditions permit free-cooling or to support a pre-occupancy purge sequence. Time period to be determined by an optimum start strategy unless otherwise specified.

4. Setback Period: Setback will typically start with the end of the occupied period and end with the start of the preoccupancy period, however it shall be provided with its own schedule. Generally systems will be off except to maintain a “setback” temperature, economization may be enabled to maintain “setback” cooling setpoint when applicable.

G. Where any sequence or occupancy schedule calls for more than one motorized unit to start simultaneously, the BAS start commands to be staggered by 5 second (adj.) intervals to minimize inrush current.

H. Wherever a value is indicated as adjustable (adj.), it shall be modifiable, with the proper password level. For these points, it is unacceptable to have to modify programming statements to change the setpoint.
I. When a power failure is detected in any phase, the BAS start commands to be retracted immediately from electrically powered units served by the failed power source. If the associated controller is powered by normal or emergency power, it may monitor its own power source as an indication of power status. If the controller is powered by uninterruptible power supply (UPS), or if it is not capable of monitoring its own power for use in sequences, provide at least one voltage monitor (three phase when applicable) per building. When the BAS detects that normal or emergency power has been restored, all equipment for which the BAS start command had been retracted to be automatically restarted in an orderly manner on staggered 5 second intervals to minimize inrush current.

J. Where reset action is specified in a sequence of operation, but a reset schedule is not indicated on the drawings, employ one of the following methods:
1. Determine a fixed reset schedule to result in stable operation and maintain the primary variable within the specified maximum allowable variance.
2. Use a floating reset algorithm which increments the secondary variable setpoint (setpoint of control loop being reset) on a periodic basis to maintain primary variable setpoint. The recalculation time and reset increment to be chosen to maintain the primary variable within the specified maximum allowable variance.
3. Primary variable to control the devices directly using a PID feedback control loop without resetting the secondary variable. However, the control devices to still modulate as necessary to maintain upper and lower limits on the secondary variable. Proportional band, integral gain, and derivative term to be selected to maintain the primary variable within the specified maximum allowable tolerance while minimizing overshoot and settling time. Gain prior approval for implementing this method of reset.

K. Where a supply air temperature or duct pressure setpoint is specified to be reset by the space temperature of the zones calling for the most cooling/heating, employ the following method:
1. Use a floating reset algorithm which increments the secondary variable (e.g., supply air temperature or duct pressure) setpoint on a periodic basis to maintain primary variable (e.g., space temperature) setpoint. The reset increment to be determined by the quantity of “need heat” or “need cool” requests from individual SCU’s. A SCU’s “need heat” virtual point to activate whenever the zone’s space temperature falls below the currently applicable (occupied or unoccupied) heating setpoint throttling range. A SCU’s “need cool” virtual point to activate whenever the zone’s space temperature rises above the currently applicable (occupied, unoccupied, or economy) cooling setpoint throttling range. The recalculation time and reset increment to be chosen to maintain the primary variable within the specified maximum allowable variance while minimizing overshoot and settling time. Reset range maximum and minimum values to limit the setpoint range.

L. Where a supply air temperature, duct pressure, or differential water pressure setpoint is specified to be reset by valve or damper position of the zone or zones calling for the most cooling/heating, the following method to be employed:
1. A floating reset algorithm to be used which increments the secondary variable (e.g., supply air temperature, pipe or duct pressure) setpoint on a periodic basis to maintain primary variable (e.g., cooling valve, heating valve, damper position) setpoint of 85 percent open. The reset increment to be calculated based on the average position of the quantity of the worst (most open valve/damper) zone(s) as specified. The recalculation
time, reset increment and control device position influence to be chosen to maintain the primal variable within the specified maximum allowable variance while overshoot and settling time. The BAS analog output value to be acceptable as indicating the position of the control device.

2. Alternatively to continuously calculating the average of the quantity of worst valve/damper positions, a method similar to the one described above may be employed whereby the “need heat” or “need cool” virtual point to increment by one unit each time a zone’s valve/damper position rises to greater than 95 percent. The quantity of “need heat” or “need cool” points to then be the basis for reset.

M. Where “prove operation” of a device (generally controlled by a digital output) is indicated in the sequence, it shall require that the BAS, after an adjustable time delay after the device is commanded to operate (feedback delay), confirm that the device is operational via the status input. If the status point does not confirm operation after the time delay or anytime thereafter for an adjustable time delay (debounce delay) while the device is commanded to run, an alarm to be enunciated audibly. Upon failure, run command to be removed and the device to be locked out until the alarm is manually acknowledged unless specified otherwise.

N. BAS to provide for adjustable maximum rates of change for increasing and decreasing output from the following analog output points:
1. Speed control of variable speed drives
2. Control Reset Loop
3. Valve Travel Limit

O. Wherever a value is indicated to be dependent on another value (i.e., setpoint plus 5 degrees F) BAS to use that equation to determine the value. Simply providing a virtual point that the operator must set is unacceptable. In this case three virtual points to be provided. One to store the parameter (5 degrees F), one to store the setpoint, and one to store the value which is the result of the equation.

P. Trend points as identified in the points list. Trends to be grouped system specific and setup in two-axis (x,y) graphical format that display object values relative to time. Setup trends to record data in 5 minute increments.

Q. **Heating Water Pumps (HWP):**
1. Pump controller receives signal from building controller, which initiates occupied or unoccupied mode.
2. Unoccupied Mode:
   a. Stop pumps.
   b. Controller operates pump whenever outside air temperature is 60 degrees F or below and one or more temperature control zones are calling for heat.
3. Occupied Mode: Heating water pump operates when outdoor air temperature is 75 degrees F or below.
4. Warm-up Mode: Heating water pump operates during warm-up mode.
5. Current transformer signals controller which generates alarm when pump/controller fails.
6. Hot water flow meter and supply and return hot water temperature sensors signal controller which calculate BTU energy demand.
7. Heating Water Pumps (HWP), Constant Speed Points List:
R. **Chilled Water Pump (CHWP):**

1. Pump controller receives signal from building controller, which initiates occupied or unoccupied mode.
2. Unoccupied Mode:
   a. Stop pump.
   b. Controller enables pump whenever the air handling unit operates during unoccupied mode and when outdoor air temperature is 80 degrees F or above.
3. Occupied Mode: Pumps enabled when outdoor air temperature is 55 degrees F or above.
4. Pump Operation:
   a. Pump operates whenever AHU cooling coil valve is 90 percent open and will be off whenever pump speed is less than 25 percent of maximum.
   b. When pump operates controller vary speed of pump to maintain cooling coil valve at least 90 percent open.
5. Chilled water flow meter and supply and return chilled water temperature sensors signal controller which calculates BTU energy demand at central plant.
6. Main Building Chilled Water Pump (CHWP) Points List:

<table>
<thead>
<tr>
<th>Points List</th>
<th>Analog In</th>
<th>Analog Out</th>
<th>Digital In</th>
<th>Digital Out</th>
<th>Alarms</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Start/Stop</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump Status (current transformer)</td>
<td></td>
<td></td>
<td>X</td>
<td>Fail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Hot Water Temp</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return Hot Water Temp</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow Meter</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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</thead>
<tbody>
<tr>
<td>Pump Start/Stop</td>
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<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump Status (current transformer)</td>
<td></td>
<td></td>
<td>X</td>
<td>Fail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling Coil Valve Position</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
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<td></td>
</tr>
<tr>
<td>Flow Meter</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Hot Water Temp</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
S. **Air Handling Unit (AHU-X), VAV HW/CHW Arrangement:**

1. General: Unit to operate under following modes: Occupied, Shutdown and Unoccupied. H-O-A switches on graphics screens or text dialog boxes may override on/off equipment.

2. Equipment:
   a. Air Handling Units: AHU-X

3. Occupied Mode:
   a. Occupied mode initiated from controller based on time of day or operator input. During occupied mode supply and return fans run continuously.
   b. Normally closed minimum outdoor air damper open.
   c. Normally closed fire smoke dampers in distribution ductwork open. Provide sufficient delay in fan start/stop to allow fire and smoke dampers to open/close without causing duct damage.
   d. Discharge air temperature sensor signals controller which modulate in sequence normally closed main outdoor air dampers and relief dampers, normally open return air dampers, normally open heating coil valve and normally closed cooling coil valve to maintain discharge air temperature setpoint.
   e. Discharge air temperature setpoint reset from the outdoor temperature according to following:
   f. Outdoor air, return air and mixed air temperature sensors signal controller. Main outdoor air damper closed when outdoor air temperature is 78 degrees F or above. Relief damper closed when outdoor air temperature is 78 degrees F or above, except relief dampers continue to modulate when minimum outdoor airflow is greater than building exhaust fan CFM plus building pressurization CFM.
   g. Remote duct static pressure sensors, as located on plans, signal controller which modulates supply fan variable frequency drive to maintain required static pressure setpoint at each location. Static pressure setpoints at each location continuously reset to maintain at least two terminal units with 100 percent damper position while maintaining space temperature setpoints.
   h. Airflow measuring stations located in supply and return fans signal controller which modulates return fan airflow according to following equation: \[
   \text{RETURN FAN CFM} = \text{SUPPLY FAN CFM} - \text{EXHAUST FAN CFM} - \text{BUILDING PRESSURIZATION}. \]
   Exhaust fan CFM is based on sum of exhaust airflows. Building pressurization airflow 5 percent of maximum supply fan capacity.
   i. Static pressure sensor in mixed air plenum signals controller which modulates return air dampers to maintain plenum pressure at negative 0.15-inch static pressure. Provide override to mixed air plenum pressure control during economizer operation. Controller modulates relief air damper in conjunction with return damper so that as return damper closes, relief air damper opens and vise versa.
   j. Airflow measuring station located in minimum outdoor air ductwork signals controller which modulates minimum outdoor air damper to maintain set airflow. If damper is 100 percent open and airflow is below setpoint, controller modulates return air dampers to maintain minimum outdoor airflow. Controller modulates relief air damper in conjunction with return damper so that as return damper...
closes, relief air damper opens and vice versa. Provide override to minimum outdoor air control during economizer operation.

k. Heating coil pump operates whenever outdoor air temperature is 50 degrees F or below and supply fan is on.

l. Controller receives RPM signal from supply and return fan variable frequency drives.

4. Shutdown Mode:
   a. Supply fan and return fan are not operating.
   b. Dampers and valves in their normal de-energized positions.
   c. Fire and smoke dampers in distribution ductwork closed.

5. Unoccupied Mode:
   a. Night Setback and Setup: Supply and return fans operate when any space temperature drops to 60 degrees F or below or rises to 85 degrees F or above in designated zones. Maintain fan operation until space temperature rises to 63 degrees F (heating) or drops to 82 degrees F (cooling). Associated exhaust fans to remain off during unoccupied operation. When fans operate, outdoor and relief air dampers closed and return air dampers open, heating coil valve open (heating) or cooling coil valve open (cooling).
   b. Warm-up Control: Optimal start program initiates warm-up control. Supply and return fans operate during warm-up. During warm-up mode outdoor and relief dampers closed, return air dampers open, heating coil valve open and cooling coil valve closed. When return air temperature reaches 70 degrees F for 30 minutes, switch to occupied mode.
   c. Night Purge Control: Night purge initiated whenever outdoor air temperature is 65 degrees F or below and any space temperature is 75 degrees F or above. Supply and return fans operate during night purge. During night purge main and minimum outdoor air dampers open, relief dampers open, return damper closed, heating coil valve closed and cooling coil valve closed. Building heating disabled. When spaces are 70 degrees F or below for 30 minutes, switch to shutdown mode.
   d. Unoccupied Mode Override: Upon receiving an “override” signal from designated space temperature sensors, controller changes building to warm-up control, and then to occupied mode for a period of 2 hours (adjustable). Coordinate location of designated sensors (quantity two) with Owner. In unoccupied mode, whenever supply and return fans operate, open fire smoke dampers in distribution ductwork. Provide sufficient delay in fan start to allow fire and smoke dampers to open without causing duct damage. When supply and return fans operate in unoccupied mode, they operate as described for occupied mode.

6. Alarms/Safeties:
   a. Smoke detectors located in return air ducts signal controller which initiates shutdown mode upon detection of smoke in airstream and generate alarm.
   b. Low limit detection thermostat located upstream of cooling coils signal controller which initiates shutdown mode upon sensing temperature below 38 degrees F and generate alarm.
   c. Differential pressure switches located across each filter bank generates an alarm when static pressure drop exceeds 0.75-inch for pre-filters and 1.2-inch for final filters.
   d. Each variable frequency drive signals controller to generate alarm in event of drive/control failure.
e. Static pressure sensor in air handler discharge signals controller which overrides supply fan speed control algorithm to limit static pressure to maximum of 3-inch and generate alarm. Discharge static pressure sensor signals controller which initiates shut down mode in event that static pressure exceeds 4.0-inch and generate alarm.

f. Static pressure sensor in relief fan inlet signals controller which overrides relief fan speed control algorithm to limit static pressure to maximum of negative 2-inch and generate alarm. Inlet static pressure sensor signals controller which initiates shut down mode in event that static pressure exceeds 3.0-inches and generate alarm.

T. **Makeup Air Unit (MAU-X), HW/CHW 100 Percent Outside Air:**

1. **General:** Unit to operate under following modes: Occupied, Shutdown and Unoccupied. H-O-A switches on graphics screens or text dialog boxes may override on/off equipment.

2. **Equipment:**
   a. Makeup Air Unit: MAU-X

3. **Occupied Mode:**
   a. Occupied mode initiated from controller based on time of day or operator input. During occupied mode supply fan runs continuously.
   b. Normally closed outdoor air damper open.
   c. Normally closed fire smoke dampers in distribution ductwork open. Provide sufficient delay in fan start/stop to allow fire and smoke dampers to open/close without causing duct damage.
   d. Discharge air temperature sensor signals controller which modulates in sequence normally open heating coil valve and normally closed cooling coil valve to maintain discharge air temperature setpoint of 55 degrees F.
   e. Outdoor air and exhaust air temperature sensors signal controller.
   f. Remote duct static pressure sensors, as located on Drawings, signal controller which modulates supply fan variable frequency drive to maintain required static pressure setpoint at each location. Static pressure setpoints at each location continuously reset to maintain at least two terminal units with 100 percent damper position while maintaining space temperature setpoints.
   g. Heating coil pump operates whenever outdoor air temperature is 65 degrees F or below and supply fan is on.
   h. Controller receives RPM signal from supply fan variable frequency drives.

4. **Shutdown Mode:**
   a. Supply fan is not operating.
   b. Dampers and valves in their normal de-energized positions.
   c. Fire and smoke dampers in distribution ductwork closed.

5. **Unoccupied Mode:**
   a. Night Setback and Setup: Supply fan operates when any space temperature drops to 60 degrees F or below or rises to 85 degrees F or above in designated zones. Maintain fan operation until space temperature rises to 63 degrees F (heating) or 82 degrees F (cooling). When supply fan operates, outdoor air dampers open, heating coil valve open (heating) or cooling coil valve open (cooling). Associated exhaust fans operate in conjunction with supply fan.
   b. Night Purge Control: Night purge initiated whenever outdoor air temperature is 65 degrees F or below and any space temperature is 75 degrees F or above. Supply
fan and associated exhaust fans operate during night purge. During night purge outdoor air dampers are open, heating coil valve closed, cooling coil valve closed and associated exhaust fans on. Building heating disabled. When spaces are 70 degrees F or below for 30 minutes, switch to shutdown mode.

c. Unoccupied Mode Override: Upon receiving an “override” signal from designated space temperature sensors, controller changes building to occupied mode for period of 2 hours (adjustable). Coordinate location of designated sensors (quantity 2) with Owner.

d. In unoccupied mode, whenever supply fan operate, open fire smoke dampers in distribution ductwork. Provide sufficient delay in fan start/stop to allow fire and smoke dampers to open/close without causing duct damage. When supply fan operates in unoccupied mode, it operates as described for occupied mode.

6. Alarms/Safeties:
   a. Low limit detection thermostat located upstream of cooling coils signal controller which initiates shutdown mode upon sensing temperature below 38 degrees F and generate alarm.
   b. Differential pressure switches located across each filter bank generates an alarm when static pressure drop exceeds 0.75-inches for pre-filters and 1.2-inches for final filters.
   c. Each variable frequency drive signals controller to generate alarm in event of drive/control failure.
   d. Static pressure sensor in air handler discharge signals controller which overrides supply fan speed control algorithm to limit static pressure to maximum of 3-inches and generate alarm. Discharge static pressure sensor signals controller which shuts down mode in event that static pressure exceeds 4.0-inches and generate alarm.

U. Terminal Units with Hot Water Reheat (TU):
   1. Terminal unit controller receives signal from building controller which initiates occupied or unoccupied mode. Input from push button on room temperature sensor initiates occupied mode for a period of 2 hours (adj.) During unoccupied mode space temperature reset to unoccupied setpoints and during occupied mode space temperature reset to occupied setpoints. When entering occupied mode, use an optimal start algorithm for warm-up or cool-down. Minimize the warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
   2. Unoccupied Mode:
      a. Close terminal unit damper and close heating coil valve or disable electric heater. Ignore any signals from space occupancy or carbon dioxide sensors.
      b. If space temperature is greater than unoccupied cooling setpoint, and if central air handling unit supply fan is running, modulate damper between minimum and maximum cooling airflow setpoints to maintain space temperature at unoccupied cooling setpoint.
      c. If space temperature is less than unoccupied heating setpoint, modulate damper between minimum and maximum heating airflow setpoints and modulate hot water coil valve subject to a maximum discharge air temperature of 95 degrees F (adj.) or initiate stages of electric heat to maintain space temperature at unoccupied heating setpoint.
   3. Occupied Mode:
a. Modulate damper to maintain minimum airflow setpoint and close hot water heating valve or disable electric heater.
b. If space temperature is greater than occupied cooling setpoint, modulate damper between minimum and maximum cooling airflow setpoints to maintain space temperature at occupied cooling setpoint.
c. If space temperature is less than occupied heating setpoint, modulate damper between minimum and maximum heating airflow setpoints and modulate hot water valve subject to a maximum discharge air temperature of 95 degrees F (adj.) to maintain space temperature at occupied heating setpoint.

d. For zones with occupancy sensors, enter “Standby Mode” if the occupancy sensor does not detect occupancy for 15 minutes (adj.). During standby mode, cooling setpoint resets to 3 degrees F (adj.) above normal occupied cooling setpoint and heating setpoint resets to 3 degrees F (adj.) below normal occupied heating setpoint. When occupancy has been detected for 5 minutes (adj.), heating and cooling setpoints reset to normal occupied temperature setpoints.

e. If space CO2 concentration is greater than 900 ppm (adj.) modulate damper between minimum and maximum cooling airflow setpoints to maintain concentration at setpoint.

4. Warm-up Mode: Terminal unit receives global signal from building controller to initiate warm-up mode. During warm-up mode modulate damper between minimum and maximum airflow setpoints and modulate hot water valve subject to a maximum discharge air temperature of 95 degrees F (adj.) or initiate stages of electric heat to maintain space temperature at occupied heating setpoint.

5. Warm-up Mode: Terminal unit receives global signal from building controller to initiate warm-up mode. During warm-up mode close hot water valve or disable electric heater and modulate damper between minimum and maximum airflow setpoints to maintain space temperature at occupied heating setpoint.

V. **General Exhaust Fan (CV):**

1. Fan controller receives signal from building controller, which initiates occupied or unoccupied mode. During occupied mode open isolation damper and run fan continuously. During unoccupied mode close isolation damper and fan off.

2. Current transformer signals controller which generates alarm when fan/controller fails to operate.

W. **Combination Fire Smoke Dampers (FSD):**

1. Dampers closed upon receiving signal from fire alarm system, or from central controller.

2. Dampers closed when their corresponding fan is not operating.

3. Dampers open when fan systems are operating, unless overridden by fire alarm system.

4. Provide LED indicators in ceiling for each FSD, indicating open, not open, status.

X. **Variable Frequency Drives (VFD):**

1. Variable speed drives monitored by controller though LAN communications port on each drive. Reference Section 23 09 13. As a minimum, monitor the following points:
   a. Frequency output - Hz
   b. Speed - RPM
   c. Current - Amps
   d. Power - Percentage
e. Runtime - Hours
f. System Fault
g. Input speed setpoint - RPM

END OF SECTION
SECTION 23 09 13
VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Variable Frequency Drive
   2. Protection Circuits
   3. Display and Control Interface
   4. Adjustments

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   4. Current edition of IEC 16800 parts 1, 2 and 3

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Product Data: Indicate voltage, controller size, ratings and size of switching and overcurrent protection devices, short circuit ratings, dimensions, weights and enclosure detains.
   2. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and name plate legends.
   3. Test Reports: Subject VFD to preliminary functional test, and final test at 104 degrees F, at full rated load. Indicate field test and inspection procedures and test results.
   4. Manufacturer's Instructions: Include installation instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.
   5. Maintenance Data: Include routine preventive maintenance schedule.
6. Compliance to IEEE 519, harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
   a. Manufacturer to provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5 percent. VFD's to include a minimum of 5 percent impedance reactors, no exceptions.

7. Rated input: Maximum electric load rating in amperes.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet following:
   1. Qualifications:
      a. Provide VFDs and options UL listed as a complete assembly. Base VFD UL listed for 100 KAIC without the need for input fuses.
      b. CE Mark: VFD to meet product standard EN 61800-3 for the First Environment restricted level. (RFI/EMI Filter specification.)
      c. Entire VFD enclosure, including the bypass, seismically certified and labeled in accordance with the International Building Code:
         1) VFD manufacturer to provide Seismic Certification and Installation requirements at time of submittal.
         2) Seismic importance factor of 1.5 rating is required, and based upon actual shake test data as defined by International Code Council AC-156.
         3) Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion by a certified lab.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ABB
B. Allen Bradley
C. Cerus
D. Danfoss
E. Eaton
F. Emerson
G. General Electric
2.2 VARIABLE FREQUENCY DRIVE

A. Description:
1. Variable Frequency Drive: Solid state, with Pulse Width Modulated (PWM) output waveform in a UL listed enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by manufacturer. Employ full wave rectifier, AC or DC Line Reactor, capacitors, and Insulated Gate Bipolar Transistors (IGBTs) as output switching device.
2. Enclosure: UL rated and UL listed as a plenum rated VFD with NEMA 1 enclosure (indoors), NEMA 3R (outdoors), NEMA 12 (for indoor dusty locations), NEMA 8 (hazardous, Class I, Div I) and NEMA 9 (Class II, Div I). Manufacturers standard enamel.
3. Drive manufacturer to supply the drive and necessary options specified. VFD's that are manufactured by a third party and "brand labeled" are not acceptable. Provide VFD's installed on this project from the same manufacturer.

B. Operating Requirements:
1. Rated Input Voltage: VAC as scheduled on drawings, plus or minus 10 percent, 3 phase, 48 to 63 Hz.
2. Rated Output Voltage: 0 to input voltage, 3 phase, 0 to 120 Hz.
3. Fundamental Power Factor: Between 1.0 and 0.97, lagging, over entire range of operating speed and load.
4. Minimum Efficiency at Full Speed and Full Load: 97 percent or better.
5. Volts Per Hertz Adjustment: Plus or minus 10 percent.
6. Current Adjustment: 60 to 110 percent or rated.
7. Acceleration Rate Adjustment: 0.5 to 300 seconds.
8. Deceleration Rate Adjustment: 1 to 300 seconds.
9. Transient protection against normal transients and surges in incoming power line.
10. Environmental Conditions: 32 degrees F to 104 degrees F at 4kHz switching frequency, 0 to 3000-feet above sea level, less than 95 percent RH, noncondensing. Circuit boards to have conformal coating.

C. Standard Features:
1. VFD's to have the same customer interface, including digital display, and keypad, regardless of horsepower rating. Provide removable keypad, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFD's.
2. Fault Mode on Loss of Input:
2. VARIABLE FREQUENCY DRIVES

a. Display fault.
b. Run at programmable preset speed as selected by user.

3. Utilize English digital display (code numbers are not acceptable). Digital Display: Three configurable lines of LCD display, backlit, adjustable contrast. Setup parameters, indications, faults, warnings, status indicators and other information in words without use of manual or cross reference table.

4. Automatic restart after overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. Programmable number of restart attempts, trial time, and time between reset attempts.

5. Capable of starting into rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

6. Automatic extended power loss ride-through circuit.

7. Customer terminal strip isolated from line and ground.

8. Keypad Hand-Off-Auto switch. When in "Off" VFD will be stopped. When in "Auto" VFD will start via external contact closure and its speed will be controlled via external speed reference. When in “Hand” VFD will be controlled via keypad up and down arrows.

9. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

10. Input Line Reactor or DC Line Choke: Five percent impedance AC or DC, to reduce harmonics to power line and to add protection from AC line transients.

11. Output filters for VFD's located more than 350 conductor feet from motor served.

12. Optimized for 4 kHz carrier frequency to reduce motor noise.

13. Disconnecting Means: Include door interlocked, UL 508C listed circuit breaker or fused disconnect switch.


15. Motor overload protection: Fused disconnects and thermal overloads for each motor when serving multiple motors from one drive.

16. Input current rating of the VFD to be no more than 3 percent greater than the output current rating. VFD's with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120.

17. VFD to provide a programmable loss-of-load (broken belt/broken coupling) Form-C relay output. Provide programmable drive to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus.

2.3 PROTECTION CIRCUITS

A. Overload Rating: 110 percent of its variable torque current rating for 1 minute every 10 minutes at 104 degrees F, and 140 percent of its H torque current rating for 2 seconds every 15 seconds.

B. 350 percent instantaneous overcurrent trip.

C. 130 percent to 65 percent over and under voltage trip.

D. Over temperature trip at 115 degrees F.

E. Short circuit protection, either running or at start, for phase to phase and phase to ground faults, phase rotation insensitive.
F. Adaptable Electronic Motor Overload (I2t).

G. EMI/RFI Filters: VFD's to include EMI/RFI filters. Onboard filters to allow the entire VFD assembly to be CE Marked and the VFD to meet product standard EN 61800-3 for the First Environment restricted. No Exceptions.

H. Orderly Shutdown: In event of any of above conditions, shutdown drive safely without component failure.

2.4 DISPLAY AND CONTROL INTERFACE

A. Serial Communications:
   1. VFD to have an EIA-485 port as standard. Standard protocols: Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet MS/TP. The use of third party gateways and multiplexers is not acceptable. Protocols “certified” by the governing authority (i.e. BTL Listing for BACnet).

B. Display operating information at VFD and provide separate interface signal for Building Automation System (BAS) via communications port to display and control following:
   1. Frequency Output - Hz
   2. Output voltage - Volts
   3. Current - Amps
   4. Speed - RPM
   5. Runtime - Hours
   6. System Fault
   7. Input Speed Setpoint - RPM
   8. On/Off Control Signal
   9. Calculated Motor Power - percentage or kW
   10. kWh meter

2.5 ADJUSTMENTS

A. Three programmable critical frequency lockout ranges.

B. Two programmable analog inputs. Analog inputs to include filters programmable from 0.01 to 10 seconds to remove any oscillation in input signal.

C. Six programmable digital inputs for maximum flexibility in interfacing with external devices.

D. Three remote contacts for fault including on/off status, fault and future configuration.

E. Two programmable analog outputs proportional to frequency, motor speed, output voltage, output current, or scalable parameter selected by Owner.

F. Run permissive circuit: Provide a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, input contact closure, time-clock control, or serial communications), the VFD to provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) to close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Provide a minimum of two separate safety
interlock inputs. When any safety is opened, the motor commanded to coast to stop and the damper commanded to close.

G. The VFD control to include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates.

H. The VFD to include a fireman's override input. Mode to override other inputs (analog/digital, serial communication, and keypad commands), except customer defined safety run interlocks, and force the motor to run at a preset speed or in a separate PID mode.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturers installation instructions. Maintain manufacturer's and NEC service clearances.

B. Install on strut support stand and brace for seismic.

C. Select and install overload heater elements in motor controllers to match installed motor characteristics.

D. Power wiring completed by the contractor, to NEC code 430.122 wiring requirements based on the VFD input current.

E. Factory certified service representative to supervise start-up in accordance with manufacturer's instructions.

F. Make final adjustments to assure proper operation of load system. Demonstrate final set-up and programming to Owner.

G. Test unit in modes of operation and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

H. Adjust ramp times to provide stable control during the balancing and commissioning process.

END OF SECTION
SECTION 23 21 13
HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
1. Heating Water Piping, Buried
2. Heating Water Piping, Above Ground
3. Chilled Water Piping, Buried
4. Chilled Water Piping, Above Grade
5. Equipment Drains and Overflows
6. Unions

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
1. Welding Certificates: Copies of certificates for welding procedures and personnel.
2. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
a. Test procedures used.
b. Test results that comply with requirements.
c. Failed test results and corrective action taken to achieve requirements.
3. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at project site.
4. Buried piping manufacturer to submit thrust block (chilled water) and anchor plate (heating hot water) layout and details including anchorage and seismic calculations.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
1. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with documented experience.
2. Welder Qualifications: Certify in accordance with ASME (BPV IX).
3. ASME Compliance: Comply with ASME B31.9 "Building Services Piping" for materials, products, and installation. Provide safety valves and pressure vessels with the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 01.

4. Refrigerant Piping:
   a. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX "Welding and Brazing Qualifications."
   c. ASME Standard: comply with ASME B31.5, "Refrigeration Piping."
   d. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical" or UL 429 "Electrically Operated Valves."

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 HEATING WATER PIPING, BURIED

A. Acceptable Manufacturers:
   1. Underground Heating Water Piping Systems:
      a. Ricwil
      b. Uponor
      c. Thermacor
      d. Rovanco
      e. Perma-Pipe
      f. Rehau
      g. Or equal.

B. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black, Grade B, ERW (Type E) or seamless (Type S).
      a. Make changes in direction with weld fittings.
      b. Where tee branches are smaller than the mains they join, weld-o-lets may be used.
      c. Provide weld fittings that are long radius and the same wall thickness as adjacent piping.
   2. Joints: Welded in accordance with AWS D1.1.
   3. Insulation: Polyurethane foam either spray applied or high pressure injected with one shot into the annular space between carrier pipe and jacket. Provide insulation rigid, 90-95 percent closed cell polyurethane with a 2.0 to 3.0 pounds per cubic foot density and coefficient of thermal conductivity (K-Factor) of 0.14 and conforming to ASTM C-591. Maximum operating temperature not-to-exceed 250 Degrees F.
   4. Jacketing Material: Provide either extruded white polyvinyl chloride, consisting of clean, virgin NSF approved Class 12454-B PVC compound, conforming to ASTM D-1784, Type 1, Grade 1 or high density polyethylene (HDPE). Provide PVC jacket with a wall thickness in mils equal to ten times the nominal jacket diameter and not less than 60
mils. HDPE to have a minimum wall thickness of 125 mils for jacket sizes equal to or less than 12-inches or 150 mils for jacket sizes greater than 12-inch to 24-inch and be used for all jacketing larger than 16-inch. No FRP, HDUP, or tape jacket allowed.

5. Provide jacketing for fittings, valves, etc. of the same material as for piping.

6. Expansion Loop and Ells:
   a. Expansion loops or expansion elbows furnished and enclosed in the same type of casing as those furnished for the standard section of the piping system.
   b. Size to permit the inner pipe or pipes to move without damage to the insulation material.
   c. Provide expansion loops or expansion elbows prefabricated and shipped to the job site in as few pieces as possible (manufacturer's recommendations to govern).
   d. Provide inner pipe loops and expansion bends cold sprung in the field as required.
   e. Provide calculations as part of submittals.

7. Moisture Barrier End Seals: Factory applied, sealed to the jacket and carrier pipe. Provide end seals certified as having passed a 20-foot head pressure test. Provide end seals with high temperature mastic completely sealing the exposed end of the insulation. Field applied end seals installed at any field cut to the piping before continuing with the installation.

C. Preinsulated Underground PEX Pipe
   1. Factory preinsulated piping system, consisting of an inner media carrier pipe, insulation around the carrier pipe, and a water/vapor seal jacket over the insulation. Rated for minimum 180F heating water at 85 PSI.
   3. Insulation: Rigid closed cell polyurethane.
   4. Outer Casing: Flexible HPDE.
   5. Each factory prefabricated section provides complete sealing of insulation at each end of conduit/casing. Provide permanent water and vapor seal.
   6. Carry over outer casing and extend to carrier pipe or use prefabricated caps specifically designed for end seal of prefabricated insulation systems. Fabricate caps of the same material as the outer casing.
   7. Manufacturers: Uponor Ecoflex or equal.

2.2 HEATING WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53/A 53M, Schedule 40, black, Type E (electric resistance welded), Grade B.
   2. Wrought Cast and Forged Steel Flanges and Flanged Fittings: ASME B16.5 including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      b. End Connections: Butt welding.
      c. Facings: Raised face.
   3. Joints: Threaded or AWS D1.1 welded.

B. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), drawn.
   2. Joints: Solder, lead free ASTM B32, HB alloy (95-5 tin antimony), or tin and silver.
3. Joints: Brazed, AWS A5.8, Classification BAg-1 (silver). Pipes 2-1/2-inches or larger or piping routed over food preparation centers, food serving facilities, food storage areas, computer rooms, telecommunications rooms, and electrical rooms.

2.3 CHILLED WATER PIPING, BURIED

A. Underground Chilled Water Piping Systems:
   1. Ricwil
   2. Thermacor
   3. Rovanco.
   4. Perma-Pipe
   5. Or equal.

B. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black, Grade B, ERW (Type E) or seamless (Type S).
   1. Fittings: ASTM A 234/A 234M, wrought steel welding type with double layer, half-lapped polyethylene tape.
   2. Weld Fittings:
      a. Changes in direction made with weld fittings.
      b. Where tee branches are smaller than the mains they join, weld-o-lets may be used.
      c. Provide weld fittings long radius and the same wall thickness as adjacent piping.
   4. Insulation: Polyurethane foam either spray applied or high pressure injected with one shot into the annular space between carrier pipe and jacket. Insulation rigid, 90-95 percent closed cell polyurethane with a 2.0 to 3.0 pounds per cubic foot density and coefficient of thermal conductivity (K-Factor) of 0.14 and conforming to ASTM C-591. Maximum operating temperature not-to-exceed 250 degrees F.
   5. Jacketing Material: Provide either extruded white polyvinyl chloride, consisting of clean, virgin NSF approved Class 12454-B PVC compound, conforming to ASTM D-1784, Type 1, Grade 1 or high density polyethylene (HDPE). Provide PVC jacket with a wall thickness in mils equal to ten times the nominal jacket diameter and not less than 60 mils. HDPE to have a minimum wall thickness of 125 mils for jacket sizes equal to or less than 12-inch or 150 mils for jacket sizes greater than 12-inch to 24-inch and used for all jacketing larger than 16-inch. No FRP, HDUP, or tape jacket allowed.
   6. Provide jacketing for fittings, valves, etc. of the same material as for piping.
   7. Expansion Loop and Ells:
      a. Expansion loops or expansion elbows furnished and enclosed in the same type of casing as those furnished for the standard section of the piping system.
      b. Size to permit the inner pipe or pipes to move without damage to the insulation material.
      c. Expansion loops or expansion elbows prefabricated and shipped to the job site in as few pieces as possible (manufacturer's recommendations to govern).
      d. Inner pipe loops and expansion bends cold sprung in the field as required.
      e. Provide calculations as part of submittals.
   8. Moisture Barrier End Seals: Factory applied, sealed to the jacket and carrier pipe. End seals certified as having passed a 20-foot head pressure test. Provide end seals with high temperature mastic completely sealing the exposed end of the insulation. Field applied end seals installed at any field cut to the piping before continuing with the installation.
   1. Fittings: ASTM D 2466, or ASTM D 2467, PVC.
   2. Joints: Solvent welded.
   3. Insulation: Polyurethane foam either spray applied or injected with one shot into the annular space between carrier pipe and jacket, and bonded to both. Insulation rigid, 90-95 percent closed cell polyurethane with a 2.0 to 3.0 pounds per cubic foot density and coefficient of thermal conductivity (K-Factor) of 0.14 and conform to ASTM C-591. Maximum operating temperature of urethane not-to-exceed 250 degrees F.
   4. Jacketing Material: Provide either extruded white polyvinyl chloride, consisting of clean, virgin NSF approved Class 12454-B PVC compound, conforming to ASTM D-1784, Type 1, Grade 1 or high density polyethylene (HDPE). PVC jacket to have a wall thickness in mils equal to ten times the nominal jacket diameter and not less than 60 mils. HDPE to have a minimum wall thickness of 125 mils for jacket sizes equal to or less than 12-inch or 150 mils for jacket sizes greater than 12-inch to 24-inch and used for all jacketing larger than 16-inch. No FRP, HDUP, or tape jacket allowed.
      a. Jacketing for fittings, valves, etc. of same material as for piping.
   5. Expansion Loops and Ells:
      a. Expansion loops or expansion elbows furnished and enclosed in the same type of casing as those furnished for the standard section of the piping system.
      b. Size to permit the inner pipe or pipes to move without damage to the insulation material.
      c. Expansion loops or expansion elbows prefabricated and shipped to the job site in as few pieces as possible (manufacturer's recommendations to govern).
      d. All inner pipe loops and expansion bends cold sprung in the field as required.
   6. Moisture Barrier End Seals: Factory applied, sealed to the jacket and carrier pipe. End seals certified as having passed a 20-foot head pressure test. Provide end seals with high temperature mastic completely sealing the exposed end of the insulation. Field applied end seals installed at any field cut to the piping before continuing with the installation.

D. Preinsulated Underground PEX Pipe
   1. Factory preinsulated piping system, consisting of an inner media carrier pipe, insulation around the carrier pipe, and a water/vapor seal jacket over the insulation. Rated for minimum 180F heating water at 85 PSI.
   2. Carrier Pipe Material: PEX piping. NSF, Combined supply and return.
   3. Insulation: Rigid closed cell polyurethane.
   4. Outer Casing: Flexible HDPE
   5. Each factory prefabricated section provides complete sealing of insulation at each end of conduit/casing. Provide permanent water and vapor seal.
   6. Carry over outer casing and extend to carrier pipe or use prefabricated caps specifically designed for end seal of prefabricated insulation systems. Fabricate caps of the same material as the outer casing.
   7. Manufacturers: Uponor or Rovanco Twinflex for combined supply/return.

2.4 CHILLED WATER PIPING, ABOVE GRADE

A. Manufacturers - Grooved Mechanical Joint Fittings and Couplings:
   1. Central Sprinkler Company; Central Grooved Piping Products
2. Anvil International
3. Shurjoint Piping Products
4. Or equal.

B. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black, Type E (electric resistance welded), Grade B.
   2. Wrought Cast and Forged Steel Flanges and Flanged Fittings: ASME B16.5 including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      b. End Connections: Butt welding.
      c. Facings: Raised face.
   3. Joints: Threaded or AWS D1.1 welded.

C. Grooved Mechanical Joint Fittings: ASTM A536, Grade 65-45-12 ductile iron; ASTM A47 (ASTM A47M), Grade 32510 malleable iron; ASTM A53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.
   1. Grooved Mechanical-Joint Couplings: Ductile or malleable iron housing and synthetic rubber gasket of central cavity pressure-responsive design for operating temperature range from -30 degrees F to 230 degrees F. Gasket material as recommended by manufacturer for design conditions.

D. Copper Tube: ASTM B 88 (ASTM B 88M), Type K (A), hard drawn.
   2. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin antimony), or tin and silver.
   3. Joints: Brazed, AWS A5.8, Classification BAg-1 (silver). Pipes 2-1/2-inches or larger or piping routed over food preparation centers, food serving facilities, food storage areas, computer rooms, telecommunications rooms, or electrical rooms.

2.5 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), drawn.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.
   3. Joints: Brazed, AWS A5.8, Classification BAg-1 (silver). Pipes 2-1/2-inch or larger or piping routed over food preparation centers, food serving facilities, food storage areas, computer rooms, telecommunications rooms, and electrical rooms.

2.6 UNIONS

A. Unions for Pipe 2-inches and Under:
   2. Copper Pipe: Bronze, soldered joints, ASME B16.22.

B. Dielectric Connections: Provide dielectric waterway or brass nipple fitting with threaded ends. Dielectric unions are not allowed.
PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's written instructions and requirements.

B. Preparation:
   2. Remove scale and dirt on inside and outside before assembly.
   3. Prepare piping connections to equipment with flanges or unions.
   4. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

C. Buried Piping Installation:
   1. Install in accordance with Drawings, specifications, and manufacturer's installation instructions. Provide a field service instructor on site to train the Contractor in all phases of installation.
   2. Underground Systems: Buried in a trench of not less than 2-feet deeper than the top of the pipe and not less than 18-inches wider than the combined outside diameter of all piping systems. A minimum thickness of 24-inches of compacted backfill over the top of the pipe is required. System installation must meet H-20 highway loading.
   3. Trench bottom to have a minimum of 6-inch of sand, pea gravel, or specified backfill material, as approved by the engineer, as a cushion for the piping. Field cutting of the pipe performed in accordance with the manufacturer's installation instructions.
   4. Provide thrust blocking, anchor plates, and concrete.
   5. Cast a concrete block over anchor plates as recommended by manufacturer. Block to sit on undisturbed trench sidewalls and/or the bottom of the trench. Concrete block to be at least the length as recommended by manufacturer and extend a minimum distance as recommended by manufacturer beyond the top and bottom of anchor plate.
   6. Pressure test buried piping.
   7. Field Service: Provided by a certified manufacturer's representative or company field service technician. The technician will be available at the job to check unloading, storing, and handling of pipe, joint installation, pressure testing and backfilling techniques.
   8. Provide identification and tracer wire, per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.
   9. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the piping systems in service. Provide temporary connections for cleaning, purging, and circulating fluids through the piping system.
   10. Use temporary strainers and temporary pumps that can create fluid velocities up to 10 feet per second to flush and clean the piping systems. Do not use Owner's permanent strainers to trap debris during pipe flushing operations. Fit the temporary construction strainers with a line size blowoff valve.
   11. When constructing minor piping modifications or additions, verify with Owner if the Owner's pumps and strainers can be used for flushing and chemical cleaning operations. When the flushing and cleaning operations are complete, ensure the strainer baskets and screens installed in the piping systems permanent strainers are replaced with clean elements. Keep temporary strainers in service until the equipment has been tested, then
replace straining element with a new strainer and clean and deliver the old straining elements to Owner. Fit the Owner's strainers with a line size blowoff valve.

12. Install bypass piping or hoses at the supply and return piping connections at heat exchangers, chillers, cooling towers, pumps, and cooling coils, etc., to prevent debris from being caught or causing damage to equipment which will be connected to the piping system.

13. Circulate a chemical cleaner in chilled and heating water piping systems to remove mill scale, grease, oil, and silt. Cleaner to be selected by chemical treatment vendor on project. Circulate for 48 hours, flush system and replace with clean water. Dispose of chemical solution in accordance with local codes. The chilled and heating water system should then be treated with chemicals and inhibitors to be selected by chemical treatment vendor on project. When the chemical cleaning is complete, remove, clean, and reinstall all permanent screens. Notify Owner so that the reinstallation of clean strainer screens may be witnessed.

14. Do not install underground piping when bedding is wet or frozen.

D. Above Ground Piping Installation:

1. Install per manufacturer's written instructions and requirements.
2. Install heating water, glycol, condenser water, piping to ASME B31.9 requirements.
   Install chilled water piping to ASME B31.5 requirements.
3. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.
4. Route piping in orderly manner, parallel to building structure, and maintain gradient.
5. Install piping to conserve building space and to avoid interference with use of space.
6. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
7. Sleeve pipe passing through partitions, walls and floors allowing adequate space for pipe insulation.
8. Slope piping at 0.2 percent upward in direction of flow and arrange to drain at low points.
9. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
10. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
11. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
12. Anchor piping for proper direction of expansion and contraction.
13. Inserts:
   a. Provide inserts for placement in concrete formwork.
   b. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   c. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4-inches.
   d. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   e. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
14. Pipe Hangers and Supports:
   a. Install in accordance with Division 23, HVAC, Hangers and Supports.
b. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

c. Place hangers within 12-inches of each horizontal elbow.

d. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

e. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

f. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

g. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

h. Provide copper plated hangers and supports for copper piping.

i. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

15. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

16. Provide access where valves and fittings are not exposed.

17. Use eccentric reducers to maintain top of pipe level.

18. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

19. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

E. Field Quality Control:

1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush system with clean water. Clean strainers.

4. Isolate equipment from piping. If a valve is used to isolate equipment, provide closure capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

6. Perform the following tests on hydronic piping:

a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

b. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.

c. Check expansion tanks to determine that they are not air bound and that system is full of water.

d. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure not-to-exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."

e. After hydrostatic test pressure has been applied for at least four hours, examine piping, joints and connections for leakage. Eliminate leaks by tightening,
repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
f. Prepare written report of testing.

F. Flushing and Cleaning of Piping Systems:
1. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the piping systems in service. Provide temporary connections for cleaning, purging, and circulating fluids through the piping system.
2. Use temporary strainers and temporary pumps that can create fluid velocities up to 10 feet per second to flush and clean the piping systems. Do not use Owner's permanent strainers to trap debris during pipe flushing operations. Fit the temporary construction strainers with a line size blowoff valve.
3. When constructing minor piping modifications or additions, verify with Owner if the Owner's pumps and strainers can be used for flushing and chemical cleaning operations. When the flushing and cleaning operations are complete, ensure the strainer baskets and screens installed in the piping systems permanent strainers are replaced with clean elements. Keep temporary strainers in service until the equipment has been tested, then replace straining element with a new strainer and clean and deliver the old straining elements to Owner. Fit the Owner's strainers with a line size blowoff valve.
4. Install bypass piping or hoses at the supply and return piping connections at heat exchangers, chillers, cooling towers, pumps, and cooling coils, etc., to prevent debris from being caught or causing damage to equipment which will be connected to the piping system.
5. Circulate a chemical cleaner in chilled and heating water piping systems to remove mill scale, grease, oil, and silt. Cleaner to be selected by chemical treatment vendor on project. Circulate for 48 hours, flush system and replace with clean water. Dispose of chemical solution in accordance with local codes. The chilled and heating water system should then be treated with chemicals and inhibitors to be selected by chemical treatment vendor on project. When the chemical cleaning is complete, remove, clean, and reinstall all permanent screens. Notify Owner so that the reinstallation of clean strainer screens may be witnessed.

END OF SECTION
SECTION 23 21 16
HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Air Vents
   2. Instrument Probe Fittings
   3. Strainers
   4. Relief Valves

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 01 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.
   2. Certificates: Inspection certificates for pressure vessels from Authority Having Jurisdiction (AHJ).
   3. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
   4. Project Record Documents: Record actual locations of flow controls.
      a. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum three years of documented experience.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Air Vents:
   2. ITT Bell & Gossett.
   3. Taco, Inc.
   4. Hoffman
   5. Amtrol
   6. Metraflex
   7. Or equal.

B. Instrument Probe Fittings:
   1. Pete's Plug
   2. Or equal.

C. Strainers:
   1. Armstrong International
   2. Mueller
   3. Keckley
   4. Hoffman
   5. Wheatly
   6. Or equal.

D. Relief Valves:
   1. Armstrong
   2. ITT Bell & Gossett
   3. Taco
   4. Amtrol
   5. Kunkle
6. Or equal.

2.2 AIR VENTS

A. Manual Type: Short vertical sections of pipe to form air chamber, with 1/8-inch brass needle valve at top of chamber.

B. Automatic Float Type: Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.3 INSTRUMENT PROBE FITTINGS

A. Brass or stainless steel body and cap, high pressure rated, valve material neoprene, Nordal or Viton to suit temperature range, 1/4-inch or 1/2-inch NPT tailpiece.

2.4 STRAINERS

A. Size 2-inches and Under: Screwed brass or iron body for 175 PSI working pressure, Y pattern with 1/16-inch stainless steel perforated screen.

B. Size 2-1/2-inches and Larger: Flanged or grooved and above: iron body for 175 PSI working pressure, Y pattern with 1/16 stainless steel perforated screen.

C. Basket Pattern: Flanged iron body for 175 PSI working pressure, basket pattern with 1/8-inch stainless steel perforated screen, clamped or bolted cover.

2.5 RELIEF VALVES

A. Size and capacity as selected by installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

B. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210F, and pressure relief at 125 PSI.

C. Pressure Relief Valves: Bronze body, test lever, ASME rated. Provide pressure relief as indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install specialties in accordance with manufacturer's instructions.

B. Support pump fittings with floor mounted pipe and flange supports. Provide vibration isolation, same as pump, to avoid short circuiting.

3.2 AIR VENTS

A. Where large air quantities can accumulate, provide enlarged air collection standpipes.
B. Automatic: Furnish and install automatic air vents in mechanical equipment rooms and outdoors only. Install at high points of system piping, at heat transfer coils, and elsewhere as required for system air venting. Vents: 3/4-inch with 1/2-inch IPS drain piping to the nearest floor drain or other approved location. Provide a ball valve and union ahead of all automatic air vents. Do not install above ceilings or locations where discharge may occur and cause damage.

C. Manual Vents: Provide at high points of system piping, at heat transfer coils, and elsewhere as required for system venting where automatic air vents are not to be installed. Provide 10-inch length of 1/4-inch copper tube with 180 degree bend down to discharge into hand-held bucket.

3.3 INSTRUMENT PROBE FITTINGS

A. Test Plugs: Install where indicated and in accordance with the manufacturer's recommendations.

3.4 STRAINERS

A. Provide valved drain and hose connection on strainer blow down connection.

3.5 RELIEF VALVES

A. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

B. Pipe relief valve outlet to nearest floor drain.

C. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

D. Water Relief Valves: Install as indicated, and on expansion tanks, hot water tanks and pressure vessels. Pipe discharge to floor drain. Comply with ASME Boiler and Pressure Vessel Code.

END OF SECTION
SECTION 23 21 23
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. General Pump Requirements
   2. In-Line Circulators

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and
   Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association,
      current edition.
   2. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports;
   3. NFPA 70 - National Electrical Code; National Fire Protection Association, current
      edition.
   4. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc.,
      current edition.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330,
   Submittal Procedures.

B. In addition, provide:
   1. Product Data: Provide certified pump curves showing performance characteristics with
      pump and system operating point plotted. Include NPSH curve when applicable. Include
      electrical characteristics and connection requirements.
   2. Manufacturer's Installation Instructions: Indicate hanging and support requirements and
      recommendations.
   3. Millwright's Certificate: Certify that base mounted pumps have been aligned.
   4. Operation and Maintenance Data: Include installation instructions, assembly views,
      lubrication instructions, and replacement parts list.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section
   01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
B. In addition, meet the following:
   1. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.
   2. Alignment: Base mounted pumps will be aligned by qualified millwright.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Mechanical Seals: One mechanical seal for each pump.

1.10 PERFORMANCE REQUIREMENTS

A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armstrong Pumps Inc.

B. ITT Bell & Gossett.

C. Taco Pumps
D. Paco Pumps
E. Wilo
F. Weil
G. Grundfos
H. Xylem
I. Or approved equivalent.

2.2 GENERAL PUMP REQUIREMENTS

A. Pump Units: Factory assembled and tested.

B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be nonoverloading over full range of pump performance curve.

C. Motors Indicated to Be Energy Efficient: Minimum efficiency as indicated according to IEEE 112, Test Method B. Provide premium efficiency motors according to IEEE 112, Test Method.

2.3 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 PSI maximum working pressure.

B. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 175 PSI maximum working pressure.

C. Casing: Cast iron, with threaded companion flanges for piping connections, and threaded gauge tappings at inlet and outlet connections.

D. Impeller: Cast bronze keyed to shaft, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.

E. Motor Bearings: Oil lubricated bronze sleeve.

F. Pump Bearings: Oil-lubricated, bronze journal and thrust type.

G. Shaft: Alloy steel with copper sleeve, integral thrust collar.

H. Seal: Mechanical seal maximum continuous operating temperature. Include carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.

I. Drive: Flexible coupling, capable of absorbing torsional vibration and shaft misalignment.

J. Motor: Resiliently mounted to pump casing.

K. Performance Electrical Characteristics:
1. As Scheduled. 1750 RPM motors unless specified otherwise; reference Section 23 05 13, Common Motor Requirements for HVAC Equipment.
2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturers written instructions and requirements.
B. See articles below for specific requirements.

3.2 GENERAL PUMP REQUIREMENTS INSTALLATION

A. Install in accordance with manufacturer's instructions according to HI 1.1-1.5 "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation.
B. Provide access space around pumps for service including removing motors, impellers, couplings, and accessories. Provide no less than minimum space recommended by manufacturer.
C. Decrease from line size with long radius reducing elbows or reducers. Eccentric reducers where necessary to prevent air entrapment. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4-inches and over. Provide vibration isolation to ensure there is no short circuiting of pump vibration isolator.
D. Unless indicated otherwise on drawings, provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve and shut off valve on pump discharge. Triple duty valves not allowed.
E. Provide totally enclosed fan cooled motors when motor is located outdoors, whether under a cover or not, or exposed to moisture. Provide protective covering for electronically commutated motors located in outdoor or wet/wash-down locations.
F. Lubricate pumps before start-up.
G. Piping installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
H. Install piping adjacent to pumps to allow service and maintenance.
I. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.
J. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
K. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
L. Install pressure gauges and temperature gauges on pump suction and discharge. Install at integral pressure-gauge tappings where provided.

M. Install temperature and pressure-gauge connector plugs in suction and discharge piping around each pump.

N. Install electrical connections for power, controls, and devices.

O. Electrical power and control wiring and connections are specified in Division 26, Electrical Sections.

P. Ground equipment.

Q. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

R. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:
   1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
   2. Review data in maintenance manuals.
   3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

S. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation.
   1. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
   2. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

T. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 IN-LINE CIRCULATORS INSTALLATION

A. Install per manufacturers written instructions and requirements.

END OF SECTION
SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Ductwork, Joints and Fittings
   2. Insulated Flexible Duct
   3. Drain Pans
   4. Ductwork Joint Sealers and Sealants

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

B. In addition, reference the following:
   1. Section 23 05 29, Hangers and Supports for HVAC Piping, Ductwork and Equipment.
   2. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Welding Certificates
   2. Field Quality Control Reports

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. NFPA Compliance:
      a. NFPA 90A Installation of Air Conditioning and Ventilating Systems.
      b. NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
   2. Comply with NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations, Ch. 3, Duct System for range hood ducts, unless otherwise indicated.
   3. Comply with SMACNA’s HVAC Duct Construction Standards - Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Provide sheet metal materials free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
4. If required, provide ductwork pressure testing per Section 23 05 93, Testing, Adjusting and Balancing for HVAC.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Duct design is generally diagrammatic and is not meant to be scaled. Major changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Ductwork, Joints, and Fittings:
   1. Ductmate
   2. Lindab Inc
   3. Nexus Inc
   4. SEMCO
   5. United McGill Corporation
   6. Ward Industries
   7. Or equal.

B. Insulated Flexible Duct:
   1. ATCO
   2. Flexmaster
   3. J.P. Lamborn Co.
   4. Hart and Cooley
   5. Or equal.

C. Ductwork Joint Sealers and Sealants
   1. Ductmate
   2. Durodyne
   3. Hardcast
   4. United McGill Corporation
   5. Vulkem
   6. Foster
   7. Childer
   8. Or equal

2.2 DUCTWORK, JOINTS AND FITTINGS

A. Materials:
1. **Galvanized Steel Ducts:** Hot-dipped galvanized steel sheet, lock-forming quality, ASTM A 653/A 653M FS Type B, with G90/Z275 coating. Ducts to have mill phosphatized finish for surfaces exposed to view.

2. **Aluminum Ducts:** ASTM B 209 (ASTM B 209M); aluminum sheet, alloy 3003-H14. 
   Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

3. **Stainless Steel:** Fabricated in accordance with ASTM A167 and A480.

B. **Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.**

1. **Lengths:** Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.

2. **Deflection:** Duct systems not-to-exceed deflection limits according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

3. **Transverse Joints:** Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

C. **Formed-On Flanges:** construct according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figure 1-4, using corner, bolt, cleat, and gasket details.

1. **Duct Size:** Maximum 30-inches wide and up to 2-inch wg pressure class.

2. **Longitudinal Seams:** Pittsburgh lock sealed with noncuring polymer sealant.

3. **Cross Breaking or Cross Beading:** Cross break or cross bead duct sides 19-inches and larger and 0.0359-inch thick or less, with more than 10 SF of nonbraced panel area unless ducts are lined.

D. **Round, Spiral Lock-Seam Ducts:** Fabricate supply ducts of material specified in this Section according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

1. **Ducts up to 20-inches in Diameter:** Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.

2. **Ducts 21- to 72-inches in Diameter:** Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.

3. **Ducts Larger than 72-inches in Diameter:** Companion angle flanged joints per SMACNA HVAC Duct Construction Standards-Metal and Flexible, Figure 3-2.

4. **Round Ducts:** Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

E. **90-Degree Tees and laterals and Conical Tees:** Fabricate to comply with SMACNA's HVAC Duct Construction Standards-Metal and Flexible, with metal thicknesses specified for longitudinal-seam straight ducts.

F. **Diverging-Flow Fittings:** Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. **Fabricate elbows using die-formed, gored, pleated, or mitered construction.** Bend radius of die-formed, gored, and pleated elbows to be 1.5 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA’s HVAC Duct Construction Standards-Metal and flexible, unless otherwise indicated.

2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
   a. Ducts 3- to 36-inches in Diameter: 0.034-inch.
   b. Ducts 37- to 50-inches in Diameter: 0.040-inch.
   c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
   d. Ducts 62- to 84-inches in diameter: 0.064-inch.

3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
   a. Ducts 3- to 26-inches in Diameter: 0.034-inch.
   b. Ducts 27- to 50-inches in Diameter: 0.040-inch.
   c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
   d. Ducts 62- to 84-inches in Diameter: 0.064-inch.

4. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.

5. Round Elbows
   a. 8-inches and Less in Diameter: Fabricate die-formed elbows for 45 and 90-degree elbows and pleated elbows for 30, 45, 60 and 90 degrees only. Fabricate nonstandard bend-angle configurations or non-standard diameter elbows with gored construction.
   b. 9 through 14-inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60 and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
   c. Larger than 14-inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.

6. Die-Formed Elbows for Sizes through 8-inches in Diameter and Pressures 0.040-inch thick with two-piece welded construction.

7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.

8. Pleated Elbows for Sizes through 14-inches in Diameter and Pressures through 10-inch wg (2500 Pa): 0.022-inch.

9. Not acceptable:
   a. Corrugated or flexible metal duct.
   b. Adjustable elbows.

H. Flat Oval Duct
   1. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with circumference equal to the perimeter of a given size of flat-oval duct.
   2. Flat Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA’s HVAC Duct Construction Standards-Metal and Flexible. Fabricate ducts larger than 72-inches in diameter with butt-welded longitudinal seams.
   3. Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
   4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
5. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.

2.3 INSULATED FLEXIBLE DUCT

A. Construction: Standard factory fabricated product. Inner wall: Impervious vinyl or chlorinated polyethylene, permanently bonded to a vinyl or zinc-coated spring steel helix.

B. Insulation: Fiberglass blanket insulation covered by an outer wall of vinyl or fiberglass-reinforced metalized vapor barrier.

C. Listing: UL 181 listed Class 1 flexible air duct material. Overall thermal transmission: No more than 0.25 BTU/in or hr/sq. degrees F at 75 degrees F differential, per ASTM C335.

D. Vapor transmission value no more than 0.10 perm, per ASTM E96

E. Pressure Rating: 4-inch wg positive pressure and 1-inch wg negative pressure.

F. Performance Air Friction Correction Factor: 1.3 maximum at 95 percent extension. Working air velocity: Minimum 2000 FPM.

G. Flame Spread Rating: No more than 25.

H. Smoke Development Rating: No more than 50 as tested per ASTM E84.

I. Insertion Loss: Minimum attenuation of 29 DB for 10-foot straight length at 8-inch diameter at 500 Hz.

2.4 DRAIN PANS

A. Primary Drain Pans: Stainless Steel, Fabricated in accordance with ASTM A167 and A480.


2.5 DUCTWORK JOINT SEALERS AND SEALANTS

A. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

B. Low Emitting Materials Requirement: Adhesives, sealants and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168.

C. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure and leakage class of ducts.

D. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.

E. Water Based Sealant for Brush-On Application: Flexible, adhesive sealant, resistant to UV light, UL-181A, and UL-181-B listed, complying with NFPA requirements for Class 1 ducts. Min. 69 percent solids, nonflammable. Hardcast Versa-Grip 181; Childers CP-146; Foster
32-19 for SMACNA 1/2, 1, 2, 3, 4, 6, and 10-inch WG duct classes, and SMACNA Seal Class A, B, or C.

F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.

G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

H. Polyurethane Sealant: General-purpose, exterior use, non-brittle sealant for gunned application. Vulkem 616 or equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. General: Use the following pressure class(es) in design of ductwork specified in this section unless otherwise noted on Drawings.

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>PRESSURE IP (inches of water)</th>
<th>LEAKAGE CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium pressure supply (fan to terminal unit)</td>
<td>0.5-inch higher than air handlers discharge pressure (min 4-inch pressure class).</td>
<td>A</td>
</tr>
<tr>
<td>Low pressure supply (downstream of terminal unit)</td>
<td>+ 1-inch</td>
<td>C</td>
</tr>
<tr>
<td>Return main (&gt;24-inch)</td>
<td>0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.</td>
<td>A</td>
</tr>
<tr>
<td>Return branch (&lt;24-inch)</td>
<td>0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.</td>
<td>B, up to -3-inch wg. A, more negative than -3-inch wg.</td>
</tr>
<tr>
<td>General exhaust</td>
<td>0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.</td>
<td>B, up to -3-inch wg. A, more negative than -3-inch wg.</td>
</tr>
<tr>
<td>Kitchen grease exhaust</td>
<td>-6-inch</td>
<td>N/A</td>
</tr>
<tr>
<td>Lab medium pressure exhaust</td>
<td>-6-inch</td>
<td>A</td>
</tr>
<tr>
<td>Hazardous exhaust</td>
<td>-6-inch</td>
<td>A</td>
</tr>
<tr>
<td>Lab low pressure exhaust</td>
<td>-1-inch</td>
<td>A</td>
</tr>
</tbody>
</table>

B. Ductwork Installation:
   1. General: Install entire duct system in accordance with drawings, Specifications, and latest issues of local Mechanical Code, NFPA 90A, and SMACNA Duct Construction Manual. At Contractor's option, rectangular ductwork may be resized to maintain an equivalent air velocity and friction rate, while maintaining a maximum aspect ratio of 3.
Remove markings and tagging from ductwork exterior surface in mechanical rooms and other locations where ductwork is exposed.

2. The duct layout shown on the Contract Drawings is diagrammatic in nature. Coordinate the ductwork routing and layout, and make alterations to the ductwork routing and layout to eliminate physical interferences. Where deviations in the ductwork routing as shown in the Contract Drawings are required, alterations may be made so as not to compromise the air flow, pressure drop, and sound characteristics of the duct fitting or duct run as shown on the Contract Drawings. In the event Architect determines that the installed ductwork is inconsistent with the above mentioned criteria, remove and replace at no additional cost to the Owner.

3. Install ducts with fewest possible joints.

4. Install fabricated fittings for changes in directions, size, shape, and for connections.

5. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12-inches, with a minimum of 3 screws in each coupling.

6. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.


9. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

10. Coordinate layout with suspended ceiling, air duct accessories, lighting layouts, and similar finish work.

11. Electrical and IT Equipment Spaces: route ducts to avoid passing through transformer vaults, electrical equipment spaces, IDF/MPOE rooms, and enclosures.

12. Boiler Rooms and Refrigeration Machinery Rooms: Only route ducts serving these rooms through these rooms.

13. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2-inches.

14. Fire- and Smoke-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire, smoke or combination fire and smoke dampers as governed by Building Code and AHJ, including sleeves, and firestopping sealant.


16. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's Duct Cleanliness for New Construction Advanced Level.

17. Paint interiors of metal ducts, that do not have duct liner, for 24-inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible duct material.

18. Install ductwork in the location and manner shown and detailed. Review deviations required by job conditions with Architect prior to any fabrication. Provide fittings for construction per SMACNA.
19. **Humidifier Duct:**
   a. Supply duct Section 15-feet downstream from humidifier.
      1) Seams water tight.
      2) Pitch down to low point. See duct drains paragraph this Section.

C. **Flanged Take-Offs:**
   1. Install at branch takeoffs to outlets using round or flex duct.
   2. Flanged take-offs secured with minimum 8-inch screw spacing (three screws minimum).
   3. Provide ductwork taps and branches off of main ducts at 45 degrees whether shown on Drawings or not (drawings are diagrammatic).

D. **Cleaning:**
   1. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.
   2. **Grille and Exposed Duct Cleaning:**
      a. After completion of ductwork installation, operate each fan system (excluding exhaust fans) for a minimum of 30 minutes prior to installation of ceiling grilles and diffusers. After grilles and diffusers are installed, clean out accumulation of particles from grilles and diffusers prior to acceptance.
      b. Clean exterior surface of ducts exposed to public view of chalk, pencil and pen marks, labels, sizing tags, dirt, dust, etc., so that upon completion of installation, ducts are left in clean and unblemished manufactured conditions.
      c. Exposed duct and grilles to remain free of dust entrained streaks due to leakage at joints and grille connections during warranty period. Clean leaks, seal and refinish to match existing if visible streaks develop.

### 3.2 DUCTWORK, JOINTS AND FITTINGS INSTALLATION

A. **Duct Materials - Applied Locations:**
   1. **General:** Use the following materials in design of ductwork specified in this Section unless otherwise noted on the Drawings.

<table>
<thead>
<tr>
<th>Location or Application</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply, Return, Transfer, and Exhaust - Low Pressure</td>
<td>Single Wall, Galvanized Steel</td>
</tr>
<tr>
<td>(downstream of terminal units)</td>
<td></td>
</tr>
<tr>
<td>Supply, Return, and Exhaust - Medium Pressure</td>
<td>Single Wall, Galvanized Steel</td>
</tr>
<tr>
<td>(upstream of terminal units)</td>
<td></td>
</tr>
<tr>
<td>General Exhaust Branch Serving Air Inlet in Shower Room or</td>
<td>Single Wall, Aluminum or Type 304 Stainless</td>
</tr>
<tr>
<td>Toilet Room with Shower</td>
<td>Steel</td>
</tr>
<tr>
<td>Supply, Return, Exhaust serving Natatorium, Pool, or Spa</td>
<td>Single Wall, Aluminum or Type 304 Stainless</td>
</tr>
<tr>
<td>Area</td>
<td>Steel</td>
</tr>
<tr>
<td>Fume Hood Exhaust</td>
<td>Single Wall, Type 316 Stainless Steel</td>
</tr>
<tr>
<td>Ductwork for the First 15-feet Downstream of Humidifier</td>
<td>Single Wall, Type 316 Stainless Steel</td>
</tr>
</tbody>
</table>

B. **Ductwork Installation:**
1. Fabricate radius elbows with centerline radius not less than 1-1/2 duct diameters.
2. Do not install duct size transition pitch angles which exceed 30 degrees for reductions in duct size in the direction of airflow, and 15 degrees for expansions in duct size in the direction of airflow.
3. Install fixed turning vanes in square throat rectangular elbows and in tees.
4. Fabricate duct turns with the inside (smallest) radius at least equal to the duct width (supply ducts) and 1.5 times radius (return and exhaust ducts). Where necessary, square elbows may be used, with maximum available inside radius and with fixed turning vanes. In healthcare settings such as hospitals and medical office buildings, square elbows and turning vanes allowed on supply ductwork only.

3.3 INSULATED FLEXIBLE DUCT INSTALLATION

A. Provide sheet metal plenum or rigid elbow and connect to diffusers and grilles with ductwork connections. Refer to Drawings for more information. Provide straight section of flexible duct with minimum length of 2-feet and maximum length of 5-feet and connect to sheet metal plenums and rigid elbows connected to diffusers and grilles, unless noted otherwise.
1. Provide round neck grilles/diffusers or square-to-round transitions. Flexible duct connections directly to diffuser and grilles is not allowed.
2. Flexible duct allowed in concealed spaces above lay-in ceilings only.

3.4 DRAIN PANS INSTALLATION

A. Install where shown on Drawings. Drain provided by Division 22, Plumbing. Provide drain (sized per code) connection from each drain pan and pipe to nearest floor drain through trap and 10-inch air gap. Drain pans over 6-feet in length require drain connections from both ends. Pitch drain pans in direction of air flow and to drain. Support secondary drain pan independently from equipment.

3.5 DUCTWORK JOINT SEALERS AND SEALANTS INSTALLATION

A. Joints and Seam Joint Sealing:
1. Seal duct seams and joints according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible for duct pressure class indicated.
2. For 1/2- and 1-inch wg pressure classes, seal transverse joints.
3. For 2- and 3-inch wg pressure classes, seal transverse joints and longitudinal seams.
4. For pressure classes more than 3-inch wg, seal transverse joints, longitudinal seams and duct wall penetrations including screw, fastener, pipe, rod, and wire.
5. Seal ducts before external insulation is applied.
6. Tape joints of PVC coated metal ductwork with PVC tape.
7. Fasteners such as sheet-metal screws, machine screws or rivets to be cadmium plated.
8. Rectangular Ductwork: Where intermediate joint reinforcement is required for duct of negative pressure class, pre-drill stiffening flange and provide fastener maximum 8-inches on center. Where retaining flanges are welded to duct wall, paint welds with zinc coating.
9. Single Wall Round Ductwork: Joint to incorporate beaded slip collar with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
10. Seal joints and seams. Apply sealant to make end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
11. Double Wall Round Ductwork: Joint to incorporate beaded slip collar or flanged connection, with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.

12. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

13. Provide openings in ductwork where required to accommodate thermometers and control devices. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

14. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities as well as Code required clearances.

END OF SECTION
SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Sheet Metal Materials
   2. Backdraft Dampers
   3. Dampers
   4. Concealed Damper Hardware
   5. Access Doors
   6. Duct Test Holes
   7. Combination Fire and Smoke Dampers
   8. Control Dampers
   9. Duct Silencers
   10. Turning Vanes
   11. Flexible Connectors

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Manufacturer's catalog data and fabrication/installation drawings for each factory fabricated duct accessory. Include leakage, pressure drop and maximum back pressure data.
   2. Shop Drawings: Indicate air duct accessories.
   3. Manufacturer's installation instructions: Provide instructions for each factory fabricated duct accessory.
   4. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
      a. See Section 01610, Basic Product Requirements, for additional provisions.
      b. Extra Fusible Links: One of each type and size.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
B. In addition, meet the following:
   1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum five years of documented experience.
   2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
   3. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
   4. AMCA 511 - Certified Ratings Program for Air Control Devices.
   5. CSFM - California State Fire Marshal Listing for Fire Damper and Smoke Damper.
   8. NFPA 92B - Smoke Control Systems in Atria, Covered Malls and Large Areas.
   10. UL 555 - Standard for Safety; Fire Dampers.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Backdraft Dampers:
   1. Air Balance
   2. Cesco
   3. Greenheck
   4. Nailor
   5. Ruskin
   6. Or equal.

B. Dampers:
   1. Air Balance
   2. Cesco
   3. Greenheck
   4. Nailor
   5. Ruskin
   6. Or equal.

C. Concealed Damper Hardware, Cable System:
   1. Young Regulator Company
   2. Or equal.

D. Access Doors:
   1. Ductmate
   2. Cesco
   3. Ruskin
4. Nailor
5. Outdoor Installation: Karp MX insulated exterior access door.
6. Or equal.

E. Duct Test Holes:
1. Ventlok
2. Or equal.

F. Combination Fire and Smoke Dampers:
1. Ruskin
2. Greenheck
3. CESCO
4. Air Balance
5. Nailor
6. Pottorff
7. Or equal.

G. Control Dampers:
1. Ruskin
2. Greenheck
3. CESCO
4. Air Balance
5. Nailor
6. Or equal.

H. Duct Silencers:
1. Industrial Noise Control
2. Ruskin Co.
3. Vibro-Acoustics
4. Or equal.

I. Turning Vanes:
1. Aerodyne
2. Ductmate Industries
3. Duro Dyne Corp
4. Metalaire Inc.
5. Ward Industries
6. Or equal.

J. Flexible Connectors:
1. Duro Dyne Corp.
2. Ventfabrics Inc.
3. Ward Industries
4. Or equal.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M. Galvanizing: 1-1/4 ounces per square foot total both sides; ducts to have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.


F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36-inches or less; 3/8-inch minimum diameter for lengths longer than 36-inches.

2.3 BACKDRAFT DAMPERS

A. Basis-of-Design: Ruskin CB D6.

B. Description: Multiple-blade gravity balanced with center pivoted blades with sealed edges, assembled in rattle free manner with 90-degree stop, adjustment device to permit setting for varying differential static pressure.

C. Frame: 0.125-inch thick 6063-T5 extruded aluminum channel with galvanized steel braces at mitered corners. Provide mounting flange.

D. Blades: Single piece, overlap frame, parallel action, horizontal orientation, minimum 0.07-inch 6063-T5 extruded aluminum material, maximum 6-inch width.

E. Bearings: Corrosion-resistant synthetic, formed as single piece with axles.

F. Blade Seals: Extruded vinyl, mechanically attached to blade edge.

G. Blade Axles: Corrosion-resistant, synthetic formed as single piece with bearings, locked to blade.

H. Tie Bars and Brackets: Galvanized steel.

I. Return Spring: Adjustable tension.

J. Damper Capacity:
2. Open Position: Maximum air velocity of 2,500-feet per minute.

K. Counterbalances: Adjustable zinc plated steel weights mechanically attached to blade. Must be capable of operating over wide range of pressures.

L. Finish: Mill aluminum.
M. Temperature Rating: -40 degrees F to 200 degrees F.

N. Operation of Blade:
   1. Start to Open: 0.01-inch wg
   2. Fully Open: 0.05-inch.

O. Pressure Drop: Maximum 0.15-inch wg at 1,500-feet per minute through 24-inch by 24-inch damper.

P. Factory Sleeve: Minimum 20 gauge thickness, 12-inches in length.

Q. Screen: At outdoor intake or discharge. 1/4-inch aluminum.

2.4 DAMPERS

A. Basis-of-Design: Ruskin MD 35.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
   1. Pressure Classes of 3-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Rectangular Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design with linkage concealed in frame and suitable for horizontal or vertical applications.
   1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum 16 gauge thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
      a. Roll-Formed Steel Blades: 16 gauge thick, galvanized sheet steel.
      b. Aluminum Frames: Hat-shaped, 10 gauge thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
      c. Roll-Formed Aluminum Blades: 10 gauge thick aluminum sheet.
      e. Blade Axles: Minimum 1/2-inch diameter, plated steel, hex shaped, mechanically attached to blade.
      f. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.
      g. Tie Bars and Brackets: Galvanized steel.
      h. Mill galvanized.
      i. Capacity:
         1) Closed Position: Maximum pressure of 3-inches wg.
         2) Open Position: Maximum air velocity of 1,500-feet per minute across 24-inch by 24-inch damper.

D. Round Volume Dampers: Single-blade suitable for horizontal or vertical applications.
   1. Steel Frames: Galvanized, roll formed, minimum of 20 gauge thick with beads at each end.
9. Capacity:
   a. Closed Position: Maximum pressure of 3-inches wg
   b. Open Position: Maximum air velocity of 1,500-feet per minute.
10. Leakage: Maximum 40 cfm at 1-inch wg for 20-inches diameter damper.
11. Pressure Drop: Maximum 0.02-inch wg at 1,500-feet per minute through 20-inch diameter dampers.

E. Jackshaft: 1-inch diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
   1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
   2. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include 2-inch elevated platform for insulated duct mounting.

### 2.5 CONCEALED DAMPER HARDWARE

A. Concealed Damper Hardware: For dampers above non-removable ceilings (gyp, plaster, decorative, etc.) where access panels have not been shown on Architectural drawings or in locations where dampers are more than 2-feet above the ceiling, provide:
   1. Concealed Damper Regulator: Young Regulator Company Model 315 or equal.
   2. Cable System: Young Regulator Company or equal.
   3. Controller: Young Regulator Company 270-275 or equal.
   4. Control wrenches, wire stops, casing nuts, and stainless steel wire.
   5. Paint cover plate to match ceiling color or as directed by Architect.

### 2.6 ACCESS DOORS

A. Duct Pressure Class 2-inch WC and Greater: Sandwich-type design with threaded locking bolt assembly. Closed cell neoprene gasket permanently bonded to inside panel. Zinc-coated steel wing nuts or polypropylene molded knobs with threaded metal inserts - zinc coated bolts sealed to inner panel.

B. Duct Pressure Class 1-1/2-inch WC and Less: Galvanized steel assembly incorporating frame, door, hinges, and latch(es). Frame tabbed for attachment to duct panel. Double wall door panel with 1-inch insulation. Open cell neoprene gasket attached to frame. Cam latches for tight closure.

C. Plenum Doors: Extruded aluminum frames with extruded santoprene seals. Double-wall 20 gauge galvanized steel door panel with fiberglass insulation.

D. Size: Maximum size available to fit rectangular duct panel dimension or round duct diameter. Plenum doors minimum 2-feet wide by 4-feet high.
E. For outdoor installation, only provide waterproof access doors installed vertically.

2.7 DUCT TEST HOLES

A. Temporary Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.8 COMBINATION FIRE AND SMOKE DAMPERS

A. Basis-of-Design:
   1. Ruskin Model FSD36, Leakage Class II, 1-1/2 hour rated, for use downstream of terminal units.
   2. Ruskin Model FSD25R, Leakage Class I, 1-1/2 hour rated, for use downstream of terminal units.
   3. Ruskin Model FSD60, Leakage Class I, 1-1/2 hour rated, for use upstream of terminal units.
   4. - C, for use in tunnel corridor applications.
   5. - FA, front access models.
   7. - M, modulating.
   8. - VALR, for use in validated systems.
   9. XP, for use in explosion proof applications.
   10. - 3, for use in 3-hour rated assemblies.

B. Ratings:
   1. Fire Resistance: UL 555 classified and provide combination fire and smoke dampers with UL label for fire rating as appropriate for construction rating and in conformance with NFPA 90A.
   2. Smoke Rating: Leakage Class Smoke Damper in accordance with UL555S. Leakage class at 4-inch wg
   3. Elevated Temperature Rating: 250 degrees F or 350 degrees F.
   4. Air Flow Rating: 2,000 feet per minute.

C. Construction:
   1. Frame: 16 gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gauge U-channel type frame.
   2. Blades (Leakage Class II):
      a. Style: Single skin with 3 longitudinal grooves.
      b. Action: Opposed.
   3. Blades (Leakage Class I):
      a. Style: True airfoil-shaped, single piece, double skin.
      b. Action: Opposed.
c. Material: Minimum 14 gauge equivalent thickness, galvanized steel.
d. Width: Maximum 6-inches.


5. Seals:
   a. Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450 degrees F and galvanized steel for flame seal to 1,900 degrees F. Mechanically attached to blade edge (glue-on or grip type seals are not acceptable).


7. Axles: Minimum 1/2-inch diameter plated steel, hex-shaped, mechanically attached to blade.

8. Mounting: Vertical or Horizontal, based on application.

   a. Close (in a controlled manner) and lock damper during test, smoke detection, power failure, or fire conditions through actuator closure spring. Actuator, at no time, to disengage from damper blades.
   b. Allow damper to be automatically and remotely reset after test or power failure conditions. After exposure to high temperature or fire, inspect damper before reset to ensure proper operation.
   c. Controlled closing and locking of damper in 7 to 15 seconds to allow duct pressure to equalize. Instantaneous closure is not acceptable.

10. Release Temperature: 165 degrees F.


12. Finish: Mill galvanized for installation in galvanized sheet metal and Type 304 stainless steel for installation in stainless steel ductwork.

13. Indicator or Auxiliary Switch Packages: Not required.

D. Factory mounting angles.

E. Factory Sleeve:
   1. Minimum 20 gauge thickness.
      a. Silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.
      b. Factory breakaway connections.
      c. Factory Tests: Factory cycle damper and actuator assembly to assure proper operation.

2.9 CONTROL DAMPERS

A. Basis-of-Design:
   1. Ruskin Model CD36, low leakage, for use in low pressure ductwork.
   2. Ruskin Model CDR25, low leakage, for use in low pressure round ductwork.
   3. Ruskin Model CDO25, low leakage, for use in low pressure oval ductwork.
   4. Ruskin Model CD60, ultra low leakage, for use in medium pressure ductwork.

B. Fabrication:
   1. Frame: 16 gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gauge U-channel.
2. **Blades (Low Leakage Dampers):**
   a. **Style:** Single skin with 3 longitudinal grooves.
   b. **Action:** Opposed blade for modulating applications, parallel blade for two position application.
   c. **Orientation:** Horizontal or vertical with thrust washers.
   d. **Material:** Minimum 16 gauge equivalent thickness, galvanized steel.
   e. **Width:** Nominal 6-inches.

3. **Blades (Ultra Low Leakage Dampers):**
   a. **Style:** Airfoil-shaped, single-piece.
   b. **Action:** Opposed blade for modulating applications, parallel blade for two position applications.
   c. **Orientation:** Horizontal or vertical with thrust washers.
   d. **Material:** Minimum 14 gauge equivalent thickness, galvanized steel.
   e. **Width:** Nominal 6-inches.

4. **Bearings:** Molded synthetic sleeve, turning in extruded hole in frame.

5. **Seals:**
   a. **Blade:** Inflatable PVC coated fiberglass material and galvanized steel. Mechanically attached to blade edge.
   b. **Jamb:** Flexible metal compression type.

6. **Linkage:** Concealed in frame.

7. **Axles:** Minimum 1/2-inch diameter plated steel, hex-shaped, mechanically attached to blade.

8. **Mounting:** Vertical or horizontal.

9. **Finish:** Mill galvanized for installation in galvanized sheet metal and Type 304 stainless steel for installation in stainless steel ductwork.

C. **Performance Data (Low Leakage Dampers):**
   1. **Capacity:** Demonstrate capacity of damper to withstand HVAC system operating conditions.
      a. **Closed Position:** Maximum pressure of 5-inches wg at a 12-inch blade length.
      b. **Open Position:** Maximum air velocity of 2,000-feet per minute.
   2. **Leakage:** Maximum 3.7 cubic-feet per minute per square foot at 1-inch wg for sizes 36-inches wide and above.
   3. **Pressure Drop:** Maximum 0.07-inch wg at 1,500-feet per minute across 24-inch by 24-inch damper.

D. **Performance Data (Ultra Low Leakage Dampers):**
   1. **Leakage:** Damper to have a maximum leakage of 3 cfm per square foot at 1-inch wg and be AMCA licensed as Class 1A.
   2. **Differential Pressure:**
      a. **Damper:** To have a maximum differential pressure rating of 13-inch wg for a 12-inch blade.
   3. **Velocity:** Damper to have a maximum velocity rating of 6,000-feet per minute.
   4. **Temperature:** Damper rated for -72 degrees F to 275 degrees F.
   5. **Pressure Drop:** Maximum 0.1-inch wg at 2,000-feet per minute across 24-inch by 24-inch damper.

E. **Actuator:** Provide actuator. See Specification Section 23 09 00, Instrumentation and Control for HVAC.
F. Factory flange frame

G. Factory Sleeve: Minimum 20 gauge thickness.

H. Duct Transition Connection: Per Drawings.

I. Factory Tests: Factory cycle damper assembly to assure proper operation.

### 2.10 DUCT SILENCERS

A. General Description: Factory-fabricated and -tested, round or rectangular silencers with performance characteristics and physical requirements as indicated.

B. Fire Performance: Adhesives, sealants, packing materials, and accessory materials to have fire ratings not exceeding 25 for flame-spread index and 50 for smoke-developed index when tested according to ASTM E 84.

C. Rectangular Units: Fabricate casings with a minimum of 0.034-inch-thick, solid galvanized sheet metal for outer casing and 0.022-inch thick, ASTM A 653/A 653M, G90 Z275 or G60 Z180, perforated galvanized sheet metal for inner casing. Provide stainless steel (type to match ductwork) solid liner for laboratory exhaust ductwork.

D. Round Units:
   1. Outer Casings:
      a. ASTM A 653/A 653M, G90 Z275 or G60 Z180, galvanized sheet steel.
      b. Up to 24-inches in Diameter: 0.034-inch thick.
      c. 26 through 40-inches in Diameter: 0.040-inch thick.
      d. 42 through 52-inches in Diameter: 0.052-inch thick.
      e. 54 through 60-inches in Diameter: 0.064-inch thick.
      f. Casings fabricated of spiral lock-seam duct may be one size thinner than that indicated.
   2. Interior Casing, Partitions, and Baffles:
      a. ASTM A 653/A 653M, G90 Z275 or G60 Z180, galvanized sheet steel.
      b. At least 0.034-inch thick and designed for minimum aerodynamic losses.

E. Sheet Metal Perforations: 1/8-inch diameter for inner casing and baffle sheet metal.

F. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression or Moisture-proof nonfibrous material.
   1. Erosion Barrier: Polymer bag enclosing fill and heat-sealed before assembly.

G. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.
   1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.
   2. Lock form and seal or continuously weld joints.
   3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
   4. Reinforcement: Cross or trapeze angles for rigid suspension.

H. Source Quality Control:
1. Acoustic Performance: Test according to ASTM E 477.
2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of at least 2000-feet per minute face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

### 2.11 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners to automatically align vanes.

B. Manufactured Turning Vanes: For medium pressure ductwork, ductwork upstream of terminal units, and in ductwork with equal inlet width and height dimensions and outlet width and height dimension, provide double thickness airfoil turning vanes. Low pressure ductwork and ductwork downstream of terminal units use either single thickness or double thickness turning vanes. For mitered rectangular elbows with changes in size from inlet to outlet, only use single thickness turning vanes. Use 2-inch radius vanes spaced on centers of 1.5-inches for single thickness. Use 2-inch radius vanes spaced on centers of 2.125-inches for double thickness.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

### 2.12 FLEXIBLE CONNECTORS

A. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Metal-Edged Connectors: Factory fabricated with a fabric strip 4-inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Select metal compatible with ducts.

   1. Minimum Weight: 26 ounces per square yard.
   2. Tensile Strength: 480 pounds of force per inch in the warp and 360 pounds of force per inch in the filling.
   3. Service Temperature: -40 degrees F to 200 degrees F.

   1. Minimum Weight: 24 ounces per square yard.
   2. Tensile Strength: 530 pounds of force per inch in the warp and 440 pounds of force per inch in the filling.
   3. Service Temperature: -50 degrees F to 250 degrees F.

   1. Minimum Weight: 16 ounces per square yard.
   2. Tensile Strength: 285 pounds of force per inch in the warp and 185 pounds of force per inch in the filling.
   3. Service Temperature: -67 degrees F to 500 degrees F.
   1. Minimum Weight: 14 ounces per square yard.
   2. Tensile Strength: 450 pounds of force per inch in the warp and 340 pounds of force per inch in the filling.
   3. Service Temperature: -67 degrees F to 500 degrees F.

PART 3 - EXECUTION

3.1 DUCT ACCESSORIES GENERAL INSTALLATION
A. Inspect areas to receive air duct accessories. Notify Engineer of conditions that would adversely affect the installation of the dampers. Do not proceed until conditions are corrected.
B. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.
C. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
D. Do not compress or stretch damper frames into duct or opening.
E. Handle dampers using sleeve or frame. Do not lift dampers using blades, actuators, or jack shafts.
F. Adjust duct accessories for proper settings.

3.2 SHEET METAL MATERIALS INSTALLATION
A. Install bracing for multiple sections to support assembly weights and hold against system pressure. Install bracing as needed.

3.3 BACKDRAFT DAMPERS INSTALLATION
A. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Provide at outside air intakes where motorized dampers are not shown on drawings.

3.4 DAMPERS INSTALLATION
A. Where installing volume dampers in ducts with liner, avoid damage to and erosion of duct liner.
B. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts for air balancing. Install at a minimum of two duct widths from each branch takeoff. Provide balancing dampers for all air inlets and outlets.
C. Install dampers square and free from racking with blade running horizontally.
3.5 CONCEALED DAMPER HARDWARE INSTALLATION

A. Coordinate location in Reflected Ceiling Plan and color of concealed damper hardware with Architect prior to installation.

3.6 ACCESS DOORS INSTALLATION

A. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
   1. On both sides of duct coils.
   2. Downstream from volume dampers, turning vanes and equipment.
   3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
   4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot (15-m) spacing.
   5. Install the following sizes for duct-mounting, rectangular access doors:
      a. One-Hand or Inspection Access: 8-inches by 5-inches.
   6. Install the following sizes for duct-mounting, round access doors:
      a. One-Hand or Inspection Access: 8-inches in diameter.
      c. Head and Hand Access: 12-inches in diameter.
   7. Label access doors.

3.7 DUCT TEST HOLES INSTALLATION

A. Provide test holes at fan inlets and outlets where indicated and where required for air testing and balancing.

3.8 COMBINATION FIRE AND SMOKE DAMPERS INSTALLATION

A. Verify that electric power is available and of correct characteristics.

B. Coordinate combination fire and smoke dampers with fire alarm system.

C. Install combination fire and smoke dampers, with fusible links, and in accordance with manufacturer's UL-approved written instructions.

D. Adjust fire and smoke dampers for proper action.

3.9 CONTROL DAMPERS INSTALLATION

A. Handle dampers using sleeve or frame. Do not lift dampers using blades, actuators or jack shafts.
B. Install control dampers in accordance with manufacturer's written instructions.

3.10 DUCT SILENCERS INSTALLATION

A. Install duct silencers independent of ducts with flexible duct connectors, lagged with loaded vinyl sheet on inlets and outlets or rigidly to ducts.

3.11 TURNING VANES INSTALLATION

A. Vanes must be installed, eliminating every other vane is not allowed.

B. Single thickness vanes cannot be over 36-inches long without intermediate vane runner.

C. Install per SMACNA and fasten/support to prevent vibration, noise, and to maintain proper alignment at design velocity

3.12 FLEXIBLE CONNECTORS INSTALLATION

A. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators. Provide sheet metal weather cover over flexible connections located outdoors. Attach sheet metal to either equipment side or ductwork side, but not both.

B. Per NFPA, do not use flexible connectors on grease exhaust fans

C. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

D. Adjust the following types in the following locations:
   1. FC-I: Indoors.
   2. FC-O: Outdoors.
   3. FC-HT: High temperature exhaust systems and smoke removal systems.
   4. FC-HC: High corrosive systems inclusive of all laboratory exhaust systems.
SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Centrifugal Fans
   2. Sidewall Exhaust Fans

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material gauges and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Motors: Premium efficiency per Section 23 05 13, Common Motor Requirements for HVAC Equipment. Electrically Commutated Motors (ECM) where scheduled on Drawings.
   2. Sound power levels as scheduled on Drawings. If not scheduled, within 5 percent of Basis of Design at design flow.
   3. Project Altitude: Base air ratings on sea-level conditions for project sites below 2,000 feet in elevation. Base air ratings on actual site elevations for project sites above 2,000 feet in elevation.
   4. Operating Limits: Classify according to AMCA 99.
   5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
6. AMCA Compliance: Products are to comply with performance requirements and are to be licensed to use the AMCA-Certified Ratings Seal.
7. NEMA Compliance: Motors and electrical accessories are to comply with NEMA standards.
8. UL Standard: HVAC Fans are to comply with UL 705. Fans used in grease exhaust applications are to be UL 762 listed for grease exhaust.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
C. Lift and support units with manufacturer's designated lifting or supporting points.

1.8 COORDINATION

A. Coordinate size and location of structural-steel support members.
B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Centrifugal Fans:
   1. Greenheck
   2. Twin City
   3. Loren Cook Company
   4. PennBarry.
   5. American Fan
   6. Or equal.

B. Sidewall Exhaust Fans:
   1. Greenheck
   2. Cook
3. Twin City
4. Or equal.

2.2 CENTRIFUGAL FANS

A. Description: Centrifugal or utility type centrifugal fans, as indicated, standard factory finish, AMCA rated, single width, single inlet, double width, double inlet, forward curved, backward inclined, or airfoil blades as scheduled.

B. Wheel and Inlet:
   1. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
   2. Forward Curved: Black enameled or galvanized steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.
   3. Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
   4. Radial: Steel construction with inlet flange, heavy reinforced back plate, plate blades with reinforcing gussets and wearing strips, welded or riveted to back plate and flange, cast iron or cast steel, hub riveted to back plate and keyed to shaft with set screws.
   5. Statically and dynamically balance wheel within its own bearings with maximum balance quality grade at bearings of G16 (0.20 in/sec peak velocity, filter-in as measured at fan RPM) for 5 hp and below and G6.3 (0.15 in/sec peak velocity, filter-in as measured at fan RPM) for 7.5 hp and above per ANSI S2.19. AMCA 210 rated.

C. Housing:
   1. Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut.
   2. Finish: Factory finish to manufacturer's standard (Permatector) or Factory finish to manufacturer's standard with Hi-Pro polyester finish exceeding 1,000 hours of salt spray under ASTM B117 test method. For fans handling air downstream of humidifiers, provide two additional coats of paint or fabricate of galvanized steel. Prime coating of aluminum parts is not allowed.
   3. Removable angles and bolts for attaching flexible connections and discharge dampers on fan outlet.
   4. Housing Discharge Arrangement: Adjustable to eight standard positions.

D. Bearings and Drives
   1. Bearings: Heavy duty pillow block type, self-greasing ball bearings, with ABMA 9 L-10 life at 50,000 hours, ball bearings, with ABMA 9 L-10 life at 100,000 hours, roller bearings, or ABMA 11, life at 120,000 hours, or roller bearings, or ABMA 11, life at 400,000 hours.
   2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard. Provide anti-corrosive coating.
3. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 5 hp and under, selected so required rpm is obtained with sheaves set at mid-position fixed sheave for 7.5 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor.

4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

5. Belt Guard: Fabricate to SMACNA Duct Construction Standards - Metal and Flexible; 0.106-inch thick, 3/4-inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

E. Motor: Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings. ODP for motors located indoors and TEFC for motors exposed to moisture.

F. Accessories:
   1. Discharge Dampers: Parallel blade heavy duty steel or aluminum, where scheduled. Damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever. Motorized where indicated and gravity actuated with counterweight, where motorized is not indicated.
   2. Inlet/Outlet Screens: Galvanized steel welded grid, removable.
   3. Access Doors: Shaped to conform to scroll, with quick opening latch type handles and gaskets.
   4. Scroll Drain: 1/2-inch steel pipe coupling welded to low point of fan scroll.
   5. Weather Hoods: Heavy gauge protective covers over bearings and shaft assembly for fans exposed to weather.
   6. AMCA 99 Type B spark proof construction where scheduled.
   7. Protective coating on fan wheel and interior of fan housing where scheduled. Apply coating before balancing fans and repair any breaks in coating which occur during balancing. One 6 mil coat of white plastic #7122 and one 6 mil coat of black plastic #7122.
   8. Vibration isolation as scheduled and specified. Reference Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment.
   9. Provide Class H insulation on motors used for smoke control.

2.3 SIDEWALL EXHAUST FANS

A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

B. Wheel:
   1. Single width, single inlet, backward inclined/airfoil blades.
   2. Aluminum hub and wheel with steel inlet bell.
   3. Statically and dynamically balanced within its own bearings.

C. Housing: One piece heavy gauge spun aluminum dome top and outlet baffle, venturi inlet cone, hinged for service.

D. Bearings and Drives
1. **Bearings:** Heavy duty pillow block type, self greasing ball bearings with ABMA 9 L-10 life at 50,000 hours.
2. **Shafts:** Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil.
3. **Drive:** Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor.
4. **Drive:** Direct drive matched to fan loads with speed controller.
5. **Belts:** Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

E. **Motor:** Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings. ODP for motors located indoors and TEFC for motors exposed to moisture.
1. Inverter duty motor for use with variable frequency drive where indicated on Fan Schedule on Drawings
2. Electrically Commutated Motor (ECM) where indicated on Fan Schedule on Drawings.

F. **Accessories:**
1. AMCA 99 Type B spark proof construction where scheduled.
2. Protective coating on fan wheel and interior of fan housing where scheduled. Apply coating before balancing fans and repair any breaks in coating which occur during balancing. One 6 mil coat of white plastic #7122 and one 6 mil coat of black plastic #7122.
3. **Variable-Speed Controller:** Where scheduled on Drawings, provide solid-state control to reduce speed from 100 percent to less than 50 percent.
4. **Variable Speed Controller:** Provide ECM Motor.
5. **Disconnect Switch:** Where not shown on Division 26, Electrical Drawings, provide nonfusible type, with thermal-overload protection mounted inside fan housing factory wired through an internal aluminum conduit.
6. **Vibration Isolation:** Wheel and motor mounted on integral double deflection neoprene isolators.

**PART 3 - EXECUTION**

3.1 **GENERAL INSTALLATION REQUIREMENTS**

A. Install in accordance with manufacturer's instructions.

B. Install power ventilators level and plumb.

C. Fans used for exhaust of kitchen grease hoods are to be UL 762 listed for grease exhaust. Provide fans with grease terminator. Pipe from grease terminator to Code approved location.

D. Fans used for exhaust of moist air are to be constructed of aluminum construction and be warranted for their application in moist conditions.

E. Fans used in welding, chemical, and/or fume exhaust applications are to be of spark-proof construction and are to be protected with coatings as required to protect parts in the air stream from the chemicals and materials the fan will be exposed to.
F. Install floor-mounting units on concrete bases.

G. Units using vibration isolation devices are scheduled on Drawings.

H. Support suspended units from structure threaded steel rods and vibration isolation device scheduled on Drawings.

I. In seismic zones, restrain support units.

J. Install units with clearances for service and maintenance.

K. Provide fixed sheaves required for final air balance.

L. Provide safety screen where inlet or outlet is exposed.

M. Pipe scroll drains to nearest floor drain.

N. Provide backdraft dampers on discharge of exhaust fans and as indicated on Drawings.

O. Duct installation and connection requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors per Section 23 33 00, Air Duct Accessories.

P. Install ducts adjacent to power ventilators to allow service and maintenance.

Q. Ground equipment.

R. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

S. Equipment Startup Checks:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Verify lubrication from bearings and other moving parts.
   6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   7. Disable automatic temperature-control operators.

T. Starting Procedures:
   1. Energize motor and adjust fan to indicated rpm.
   2. Measure and record voltage and amperage.
U. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

V. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

W. Shut unit down and reconnect automatic temperature-control operators.

X. Replace fan and motor pulleys as required to achieve design airflow.

Y. Provide totally enclosed fan cooled motors when motor is located outdoors, whether under a cover or not, or exposed to moisture.

Z. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

AA. Adjust damper linkages for proper damper operation.

AB. Adjust belt tension.

AC. Lubricate bearings.

AD. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

AE. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

AF. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC fans. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

3.2 CENTRIFUGAL FANS

A. See 3.1, General Installation Requirements above.

3.3 SIDEWALL EXHAUST FANS

A. See 3.1, General Installation Requirements above.

END OF SECTION
SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY
A. Work Included:
   1. Single Duct Variable Volume and Constant Volume Units

1.2 RELATED SECTIONS
A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS
A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS
A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE
A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY
A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Titus
B. Price
C. Krueger
D. Trane
E. Nailor
F. Greenheck
G. Or equal.
2.2 SINGLE DUCT VARIABLE VOLUME AND CONSTANT VOLUME UNITS

A. Casings: Minimum 22 gauge galvanized steel.

B. 1/2-inch dual density insulation which complies with UL 181 and NFPA 90A. Exposed insulation edges to be coated with NFPA 90A approved sealant to prevent entrainment of fibers in the airstream.

C. Engineered polymer foam insulation which complies to UL181 and NFPA 90A. Insulation to be 1-1/2 pound density, closed cell foam. Exposed fiberglass is not acceptable. The insulation to be mechanically fastened to the unit casing.

D. Non-porous, sealed liner which complies with UL 181 and NFPA 90A. Insulation to be 4-pound density. Cut edges must be sealed from the airstream using mechanically bonded metal barrier strips. Liners made of Mylar, Tedlar, Silane or woven fiberglass cloth are not acceptable.

E. 1-inch thick matte faced insulation, meeting UL 181 and NFPA 90A, enclosed between the unit casing and a non-perforated internal 22 gauge sheet metal cover extending over the fiberglass insulation, as well as covering the liner cut edges.

F. Plenum Air Inlets: Round stub connections or S slip drive connections for duct attachment.

G. Plenum Air Outlets: S slip and drive connections.

H. Casing Leakage: Maximum casing leakage not to exceed 10 cfm at 1-inch static pressure for inlet size larger than 12-inches and not to exceed 7 cfm at 1-inch static pressure for inlet size 12-inches and smaller.
   2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 7 cfm maximum at inlet static pressure. Shaft to be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. Damper to incorporate a mechanical stop to prevent over stroking and a synthetic seal to limit close off leakage to the maximum values shown in the damper leakage table.
   3. Flow Sensor: Integral averaging type flow sensor utilizing multiple sensing points with unit mounted calibration chart.
   4. Mount damper operator to position damper normally open.

I. Attenuator Section: Line attenuator sections with 2-inch thick insulation.

J. Hot Water Heating Coil:
   1. Construction: 1/2-inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 PSIG pressure, factory installed.

K. Electric Heating Coils:
   1. Construction: UL listed, slip-in type, open coil design, integral control box factory wired and installed with:
      a. Primary and secondary over-temperature protection.
b. Minimum airflow switch.
c. Integral door interlock disconnect switch
d. Pneumatic/electric switches and relays or Magnetic contactor for each step of control.

2. Electrical Characteristics: Reference Drawings.

L. Acoustics: Sound ratings tested as power level 10-12 watts in accordance with AHRI 880 standard at 1.5-inches WG inlet static pressure. NC ratings calculated per AHRI 885-2008 with room attenuations as listed in Appendix E, and not to exceed values scheduled on drawings.

1. MAXIMUM AIRBORNE SOUND POWER (db)
   a. OCTAVE BAND AND CENTER FREQUENCY (HZ)
   b. Units must have 5-feet 0-inches of 2-inch thick lined duct downstream of terminal unit.

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M. DDC Controls: Damper operator, sensor, and other devices compatible with temperature controls specified in 23 09 00, Instrumentation and Control Performance Specifications.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Upon completion of installation and prior to initial operation, test and demonstrate that air terminals and duct connection to air terminals are leak tight. Repair or replace air terminals and duct connections as required to eliminate leaks and retest to demonstrate compliance.

B. Verify that installation of each air terminal is according to the Contract Documents.

C. Check that inlet duct connections are as recommended by air terminal manufacturer to achieve proper performance.

D. Check that controls and control enclosure are accessible.

E. Verify that control connections are complete.

F. Check that nameplate and identification tag are visible.

G. Verify that controls respond to inputs as specified.
3.2 SINGLE DUCT VARIABLE AND CONSTANT VOLUME UNITS

A. Install in accordance with manufacturer's instructions. Install level and plumb.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork.

D. Provide 9-inch by 9-inch access door with quarter turn latches upstream and downstream of each heating coil.

E. Provide minimum five duct diameters minimum straight duct run upstream of terminal unit.

F. Minimum of 3-feet straight duct downstream of terminal unit prior to first outlet or first branch duct.

G. Branch inlet duct size to match unit inlet connection. For branch inlet ducts over 15-feet long, increase branch duct size one size and provide transition immediately upstream of minimum straight duct run.

H. Connect to ductwork in accordance with Section 23 31 00, HVAC Ducts and Casings.

I. Provide minimum of 5-ft of 1-inch thick lined ductwork downstream of units. Lining to match terminal unit lining type.
   1. Do not provide lined ductwork in group "H" occupancies.

J. Verify that electric power is available and of the correct characteristics.

K. Balance unit to air flows scheduled.

END OF SECTION
SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Grilles, Registers, Diffusers
   2. Louvers
   3. Roof Vents

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
   2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
   3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size and accessories furnished.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Air Distribution Diffuser, Register, and Grille Schedule lists Basis of Design, with any specialty accessories, construction, finish or other criteria noted on schedule. Submitted air distribution must match criteria of Basis of Design:
      a. Construction materials and appearance.
      b. Frame/installation method.
      c. Isothermal throw plus or minus 5 percent at design flows shown on drawings.
      d. Noise Criteria: NC value plus or minus 1 at design flows shown on drawings.
      e. Accessories: Equal to Basis of Design.
1.6 **WARRANTY**

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

**PART 2 - PRODUCTS**

2.1 **MANUFACTURERS**

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23, HVAC sections, where more than a single type is specified for the application, provide single selection for each product category.

B. Grilles, Registers, Diffusers:
   1. Anemostat
   2. Carnes
   3. Environmental Air Products
   4. Kruger
   5. Metalaire
   6. Nailor
   7. Price Co.
   8. Shoemaker
   9. Titus
   10. Tuttle & Bailey
   11. Seiho
   12. Or equal.

C. Louvers:
   1. Ruskin Manufacturing
   2. Pottorff
   3. Carnes
   4. Cesco
   5. Greenheck
   6. Or equal.

D. Roof Vents:
   1. Western
   2. Or equal.

2.2 **GRILLES, REGISTERS, DIFFUSERS**

A. Diffuser, Register and Grille Schedule lists Basis of Design, with specialty accessories, construction, finish or other criteria noted on schedule. Submitted air distribution must match criteria of Basis of Design, including accessories and finish:
   2. Pressure drop equal to or less than Basis of Design at CFM on Drawings.
   3. Throw: Isothermal jet throw plus or minus 5 percent of Basis of Design at CFM listed on Drawings.
4. Noise Criteria: Plus or minus 1 NC of Basis of Design at CFM listed on Drawings. If Basis of Design NC is below registered level, submitted must match. NC rating with 10 dB room factor or less.

B. Provide 1-, 2-, 3-, or 4-way deflection as indicated on Drawings.

C. Provide pattern controllers for linear supply air diffusers.

D. Register Dampers: Dampers utilized with grilles. Opposed blade dampers utilizing a side operated worm drive which provides external duct operation. Slot the end of the shaft to receive a screwdriver. Factory assembled side operator. Construct of the same material as the grille. Manufacturer same as grilles/diffuser.

E. Coordinate mounting frames with ceiling construction type. Verify per reflected ceiling plans.

2.3 LOUVERS

A. General: Frame and sill styles compatible with adjacent substrate, specifically manufactured to fit into construction openings with accurate fit and adequate support for weatherproof installation. Reference Drawings and Specifications for types of substrate which will contain each type of louver. Construct of aluminum extrusions, ASTM B221, Alloy 6063-T5. Weld units or use stainless steel fasteners. On inside face of exterior louvers, provide anodized aluminum wire bird screen mounted in removable extruded aluminum frames. AMCA licensed performance ratings.

B. Blades set 3 to 5-inches on center, 37.5 degree angle with rain hook on blade, minimum blade thickness 0.080-inch, drainable blade style. Minimum 57 percent free area for 48-by 48-inch unit. Maximum water penetration 0.01 ounce water psf free area at 1000 FPM. Maximum intake pressure drop of 0.10-inch wg at 750 FPM free velocity. Provide downspouts in jambs, designed to drain water from louver for minimum water cascade from blade to blade. Provide drain gutter in head frame and each blade.

C. Reference Drawings for free area required.

D. Provide access door in duct to clean birdscreen.

E. Finish: Factory Kynar 500 fluoropolymer spray finish color to be selected by Architect. Conform to AAMA 605.2. Apply coating following cleaning, and pretreatment. Dry louvers before final finish application. 1.2 mils total dry film thickness when baked at 450 degrees F for ten minutes.

2.4 ROOF VENTS

A. Standard Type: Furnish and install to match roof exhaust fan hoods. Sizes shown on Drawings. Provide accessories, such as inlet motorized damper, curb, screens per drawings and schedule.

B. Turbine Type: Furnish and install Turbine Roof Ventilator.
PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install in accordance with manufacturer's instructions. Provide seismic supports, clips, and bracing per local code. Coordinate installation of framing. Provide complete coverage of rough openings by integral device flanges or auxiliary frames. Where above ceiling location is unconditioned space, caulk rough openings; repair and re-paint locations where dust entrainment streaks develop due to unsealed openings.

B. Damp locations, such as lockers, restrooms, showers, natatoriums, whirlpool/spas, to have aluminum construction even if scheduled otherwise; mounting hardware to be stainless steel.

C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

D. Unless otherwise shown on drawings, for ceiling mounted air outlets with adjustable airflow pattern controllers mounted at a height of 12 feet or less, adjust the air outlets for horizontal air distribution, and adjust to vertical air distribution for ceiling height above 12 feet.

E. Exterior color of grilles per Architect. White finish if not otherwise scheduled or noted by Architect. Paint ductwork visible behind air outlets and inlets matte black.

F. Ceiling Membrane: Protect ceiling membrane per code. Fire caulk around openings. Provide listed radiation damper in rated roof/ceiling or floor/ceiling assemblies as required per code.

G. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.2 GRILLES, REGISTERS AND DIFFUSERS INSTALLATION

A. Coordinate with Architectural Reflected Ceiling Plan(s). Reflected ceiling plans determine final locations.

B. Install diffusers to ductwork with air tight connection. 18-inch straight duct section or acoustic plenum at connection. Provide square to round adapters where required for connection to round ducts.

C. Provide integral balancing dampers for diffusers, and grilles and registers where duct manual balancing dampers are not shown or specified.

D. Linear Slot Diffusers:
   1. Coordinate connection plenum dimensions with linear slot final dimensions to conform with manufacturer's recommendations, or as indicated. Total and active lengths as noted on drawings. Blank off unused sections. Coordinate frame type with Architect.
   2. Paint surfaces visible behind air outlets and inlets, including blank-off sections, matte black unless otherwise called for on drawings.

END OF SECTION
SECTION 23 40 00
HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Medium Efficiency Pleated Filters
   2. High Efficiency Pleated Filters
   3. Filter Frames and Housings
   4. Filter Gauges

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC apply to this Section.

B. In addition, reference the following:
   1. Section 01500, Temporary Facilities and Controls: Filters for temporary heating and ventilating.
   2. Division 26, Electrical, Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. ARI 850 - Commercial and Industrial Air Filter Equipment; Air-Conditioning and Refrigeration Institute.
   6. UL 586 - High Efficiency, Particulate, Air Filter Units; Underwriters Laboratories Inc.
   7. UL 867 - Electrostatic Air Cleaners; Underwriters Laboratories Inc.
   8. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.
B. In addition, provide:
1. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.
2. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
3. Samples: Submit two samples of replacement filter media of each type and each filter frame.
4. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.
5. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.
6. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   a. Extra Filters: One set of each type and size.

1.5 QUALITY ASSURANCE
A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
B. In addition, meet the following:
1. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 WARRANTY
A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 PERFORMANCE REQUIREMENTS
A. Conform to ARI 850, Standard for Performance Rating of Commercial and Industrial Air Filter Equipment, Section 7.4.
   1. Dust Spot Efficiency: Plus or minus 5 percent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Filters:
   1. American Filtration Inc.
   2. AAF International/American Air Filter
   3. Camfil Farr Company
   4. Eco-Air Products
   5. Filtration Group
   6. Flanders Corporation
   7. Or equal.
B. Filter Gauges:
   1. Dwyer Instruments
2. H.O. Treric Co.
3. Weiss Instruments
4. Or equal.

2.2 MEDIUM EFFICIENCY PLEATED FILTERS

A. Media: Blend of cotton and polyester fiber, pleated, support grid, enclosing frame, UL 900.
   1. Thickness 2-inch.

B. Performance Rating per ASHRAE Standard 52.2:
   1. MERV 7.
   2. Dust Spot Efficiency: 25 to 30 percent.
   3. Face Velocity: 500 FPM.
   4. Initial Resistance: 0.30-inch WG.
   5. Recommended Final Resistance: 0.90-inches WG.

C. Frame: Provide galvanized steel frame, including support hardware with air tight seal around frame, upstream servicing.

2.3 HIGH EFFICIENCY PLEATED FILTERS

A. Media: Microfine glass fiber laminated to reinforcing backing, pleated, support grid, mechanically and chemically bonded to enclosing frame, UL Class 1.
   1. Thickness: 12-inch.

B. Performance Rating per ASHRAE Standard 52.1 and Standard 52.2:
   1. MERV 13.
   2. Dust Spot Efficiency: 40 to 45 percent.
   3. Face Velocity: 500 FPM.
   4. Initial Resistance: 0.25 inch WG.
   5. Recommended Final Resistance: 1.50-inches WG.

C. Frame: Provide galvanized steel frame, including support hardware with air tight seal around frame, upstream servicing.

2.4 FILTER FRAMES AND HOUSINGS

A. Provide housings located outdoors that are suitable for outdoor installation. Housings to be insulated and have suitable access to the filters for easy removal.

B. General: Fabricate filter frames and supporting structures of 16 gauge galvanized steel or extruded aluminum T-Section construction with necessary gasketing between frames and walls.

C. Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters, size for 24- x 24-inch filter media, minimum 2-inches thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

D. Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters, size for 24- x 24-inch filter media, minimum 2-inches thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.
E. Side Servicing Housings: Flanged for insertion into ductwork, of reinforced 16 gauge galvanized steel; access doors with continuous gasketing and positive locking devices on both sides; extruded aluminum tracks or channels for primary secondary filters with positive sealing gaskets.

2.5 FILTER GAUGES

A. Direct Reading Dial: 3-1/2-inch diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 0-0.5-inch WG, 2 percent of full scale accuracy.

B. Direct Reading Dial: 2-inch diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 2.0-inch WG, 3 percent of full scale accuracy.

C. Inclined Manometer: One piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0-3-inch WG, 3 percent of full scale accuracy.

D. Accessories: Static pressure tips with integral compression fittings, 1/4-inch aluminum tubing, 2-way or 3-way vent valves.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Provide and install filter gauge static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position/location. Adjust and level.

D. Operation During Construction: If air handlers are operated during construction, provide treated 2-inch media construction filter in front of prefilters and replace periodically to prevent dirt carryover. Install clean prefilters prior to air balancing.

E. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

F. Provide filter gauges on filter banks, installed with separate static pressure tips upstream and downstream of filters.

END OF SECTION
SECTION 23 73 13
MODULAR AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Casing
   2. Supply Return and Exhaust Fans
   3. Motor and Drive
   4. Hydronic Coils
   5. Filters
   6. Dampers
   7. Electrical

1.2 RELATED SECTIONS

A. Contents of Section 23 00 00, HVAC Basic Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and
   Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air
      Movement and Control Association International, Inc. (ANSI/AMCA 210, same as
      ANSI/ASHRAE 51).
   2. ARI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment.
   4. ARI 430 - Standard for Central Station Air Handling Units.
   5. ARI-DCAAACP - Directory of Certified Applied Air Conditioning Products.
   6. AFBMA 9-90 - Load Ratings and Fatigue Life for Ball Bearings.
   9. ASTM D1654 - Standard Method for Evaluation of Painted or Coated Specimens Subjected to
      Corrosive Environments.
   14. Units with factory wiring to be UL/ETL/CSA approved and labeled.
   15. Filter media to be ULC listed.
1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Product Data:
      a. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
      b. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
      c. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
      d. Hydronic Coils: Computer selection data for each coil bank indicating entering/leaving air conditions, entering/leaving fluid conditions, heating/cooling capacity, fluid flow, face velocity, air pressure drop, fluid pressure drop and circuiting. Coil selections corrected for elevation and glycol content if applicable.
      e. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
      f. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
   2. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
   3. Manufacturer's Instructions: Include installation instructions
   4. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, accessories listed in this specification, and wiring diagrams.
   5. Certificates: Certify that coil capacities, pressure drops and selection procedures meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Certification: Certify air-handling units in accordance with ARI 430.
   3. Performance Criteria:
      a. Fan schedule indicates design cubic feet per minute and design static pressure. Scheduled fan motors, 375 watts (1/2 horsepower) and larger, are sized for the maximum of present or future design cubic feet per minute at 110 percent design static pressure, but not to exceed (3/4-inch water gauge) 187 Pa additional pressure.
      b. Provide fans and motors capable of stable operation at design conditions cubic feet per minute and 110 percent pressure as stated above.
c. Select fan operating point to right hand side of peak static pressure point and near the peak of static efficiency.

d. Operating Limits: AMCA 99.

4. Provide units constructed by a manufacturer who has been manufacturing air handling units for at least five years.

5. Ship units in one piece where possible and in shrink wrapping to protect the unit from dirt, moisture and/or road salt. Shipping splits can be provided as required for installation. Lifting lugs will be supplied on each slide of the split to facilitate rigging and joining of segments.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers:
   1. Carrier 39M Air Handler
   2. Trane Performance Climate Changer Air Handler
   3. York, A Johnson Controls Company
   4. Or equal.

2.2 GENERAL

A. Configuration: Fabricate with fans plus accessories including:
   1. Hydronic Coils
   2. Direct Expansion Coils
   3. Motors
   4. Filters
   5. Dampers
   6. Heat Wheel
   7. Heat Pipe
   8. Flat Plate Heat Exchanger
   9. UVGI System

B. Fabrication: Conform to AMCA 210 and ARI 430.

C. Description: Provide factory-fabricated indoor or roof mounted outdoor air handling unit(s) with capacity and accessories as indicated on the schedule. Units to have overall dimensions as indicated and fit into the space available with adequate clearance for service. Units to come completely assembled. Ship multiple sectioned units as a single factory assembled piece (except where shipping limitations prevent or access into the building is required) de-mounted into modular sections in the field by the contractor. Furnish units with sufficient gasket and bolts for reassembly in the field by the contractor. Electrical components and assemblies to comply with NEMA standards. Unit internal insulation must have a flame spread rating not over 25 and smoke developed rating no higher than 50 complying with NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems." Units to comply with NFPA
2.3 CASING

A. Construction: Construction of the air handling unit to consist of a G-90 galvanized steel frame 16 gauge painted galvanized steel frame with formed 16 gauge galvanized steel exterior casing panels. Provide exterior casing panels attached to the gasketed steel frame with corrosion resistant fasteners. Provide casing panels completely removable from the unit exterior without affecting the unit's structural integrity. Air handling unit casing to be of the “no-through-metal” design. Casing to incorporate insulating thermal breaks to ensure that, when fully assembled there is no path of continuous unbroken metal to metal conduction from inner to outer surfaces. Provide necessary support to limit casing deflection to L/200 of the narrowest panel dimension at plus or minus 6-inches wg Caulk and seal panel seams for an airtight unit. Leakage rates to be less than 1 percent at plus or minus 6-inches wg. Exterior Panel Finish: Painted with a polyester resin coating designed for corrosion resistance meeting or exceeding ASTM B-117 Salt Spray Resistance of 1,000 hrs at 95 degrees F, and ASTM D-2247 Humidity Resistance of 1,000 hrs at 95 degrees F.

B. Double Wall - Interior Liner:
   1. Each unit to have double wall construction with 20 gauge solid galvanized liner in the sections downstream of final filters or entire unit. 20 gauge perforated galvanized liner in the entire unit. Provide removable double wall interior panels from the outside of the unit without affecting the structural integrity of the unit.
   2. Provide perforated sections furnished with neoprene, tedlar, or mylar liner used to prohibit the erosion of the insulation into the air stream.
   3. Protect insulation edges with metal lagging. Insulation systems using stick pins or adhesives are not acceptable.

C. Floor: Provide unit perimeter base fabricated using heavy gauge structural steel tubing. Provide cross supports to perimeter base steel tubing. Base rails to include lifting lugs welded to perimeter base at the corner of the unit or each section if de-mounted. Entire base frame is to be painted with a phenolic coating for long term corrosion resistance. Provide internal walk-on floor 10 gauge aluminum tread plate and secured to the cross supports and perimeter base with corrosion resistant fasteners. Provide outer floor of the unit made from 16 gauge galvanized steel sealed and secured to the underside of the unit. Provide 4-inch double wall floor foam insulated or insulated with fiberglass insulation. Provide floor seams that are gasketed for thermal break and sealed for airtight/watertight construction. Single wall floors with glued and pinned insulation and no sub floor are not acceptable. Provide base frame attached to the unit at the factory. Drain connections on floor mounted air handling units to terminate at the side of the unit.

D. Insulation: Entire unit to be insulated with a minimum R-13 fiberglass insulation. Coefficients to meet or exceed a 3.0 P.C.F. density material rating. Insulation to meet the erosion requirements of UL 181 facing the air stream and fire hazard classification of 25/50 (per ASTM-84 and UL 723 and CAN/ULC S102-M88). Insulation edges encapsulated within the panel. Perforated sections or single wall units to have insulation with black acrylic coating.

E. Access Doors:
1. Provide unit equipped with solid double wall insulated, hinged access doors. Provide foam filled extruded aluminum or galvanized steel door frame of same gauge as unit cabinet construction and interior liner with a built in thermal break barrier and dual full perimeter gasket forming an air tight seal. Provide door hinge assembly die cast zinc with stainless steel pivot mechanism, completely adjustable. Provide ETL and UL approved tool operated safety latch on fan section access doors. Doors must be the same thickness as the unit casing.

2. Access Door Handles: Minimum of two heavy duty high pressure latches operable from either side of the door to be provided.

3. Positive pressure doors open inward and negative pressure doors open outward.

4. Provide wired glass window at the following location for inspection of fan/motor, downstream of coils, humidifier, or entire unit.

5. Where double wall interior liner is specified to be suitable for pressure washing, construct access doors of same construction.

2.4 SUPPLY, RETURN AND EXHAUST FANS

A. Forward Curved (FC) DWDI Fans: Provide heavy gauge galvanized steel construction fan housing. Fan scroll bolted to assembly frame. Provide heavy duty fan bearings, pillow block, self-aligning ball type. Bearings selected for a minimum L-50 life of 200,000 hours at the maximum horsepower and operating speed for the classification. Fan shaft turned, ground and polished solid steel rated at maximum RPM below critical speed. Fan wheel and sheaves keyed to the shaft. Provide IRD balanced fan (per ANSI / AMCA 204-96 fan application category BV-3) at design RPM with belts and drives in place to a vibration velocity less than or equal to 0.157-inch per second measured horizontal and vertical at each bearing pad. Vibration amplitudes are in inches/second-Peak. Values are filter-in at the fan speed. Provide fan rated in accordance with AMCA 210 for performance and AMCA 300 for sound.

B. Provide flexible duct connections to separate fan from adjacent sections. Reference Section 23 33 00, Air Duct Accessories.

C. Provide the following accessories on fans:
   1. Pressure relief fittings furnished on bearings.
   2. Stainless steel shaft.
   3. Internally spring isolated fan, motor and drive on a structural steel base complete with UV rated flexible connection. Formed metal isolation bases will not be acceptable. Provide seismically restrained isolator type with 1-inch, 2-inch, or 3-inch deflection in accordance with code and AHJ. Reference Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.
   4. Provide airflow monitoring device at the inlet of supply and return fans. Air monitoring device to consist of an array of differential pressure flow sensors mounted at opposing 90 degree positions around the inlet of the plenum fan. Provide flow sensors manifolded together with pneumatic tubing to form a piezometric ring. Each fan assembly and air monitoring device to have been tested for airflow vs. differential pressure and calibrated in an AMCA Accredited Laboratory throughout the fans range of operation. 4-20ma low pressure transducer with accuracy of plus or minus 1 percent full span and temperature compensated from 25 degrees F to 150 degrees F, mounted on fan inlet plate or fan bulk head wall to provide feedback and input to BMS. Air monitoring device not to obstruct
the fan inlet, be directly mounted across the fan inlet or have any effect on fan air performance or sound power levels. Display to be as follows:

a. Provide a method of displaying digitally, in real time, the fans current airflow. Provide display capable of showing the airflow of all fans simultaneously. For interaction with a controller, the display to output one 0-10 VDC signal for each fan being monitored. The display to require no maintenance throughout its life. Output signal to be accurate to plus or minus 8.5 percent of Natural Span, including non-linearity, hysteresis and non-repeatability. The display must be water tight allowing for use in outdoor locations. If the display is not water tight, install in a weatherproof housing.

5. Extended lubrication lines to exterior of unit casing.

D. Provide metal belt guard for fans equipped with belt drives. Provide inlet screens.

2.5 MOTOR AND DRIVE

A. Fan motors are to be mounted and isolated on same integral base as fan.

B. Motors: Open drip proof or Totally enclosed fan cooled. Reference Section 23 05 13, Common Motor Requirements for HVAC Equipment.

C. Provide shaft grounding on motors served by variable frequency drives.

D. Direct drive or V-belt drive sized for 150 percent of motor horsepower, with variable sheaves for 7.5 hp or lower motors and fixed sheaves for 10 hp and greater motors.

2.6 HYDRONIC COILS

A. Coils certified by manufacturer in accordance with ARI Standard 410, capacities as indicated on drawings.

B. General: Extended surface type consisting of copper tubing mechanically expanded to bond with plate fins. Design for serpentine flow with one or more feeds from common supply and return headers. Arrange for counter flow operation with supply connections at the bottom.

C. Performance: Provide capacity indicated at water flows no greater than scheduled.

D. Factory Testing: Leak test coils under water at 300 PSIG minimum.

E. Working Pressure: 150 PSIG or 250 PSIG.

F. Construction:
   1. Tubing: Seamless Copper.
   2. Fins: Copper or Aluminum die formed plates. Continuous within the coil casing.
   3. Casing 16 gauge: Stainless steel or Galvanized steel.
   4. Headers: Seamless copper tube brazed to heat transfer tubes. Provide high point vent fitting and low point drain fitting.
   5. Connections: Same end for supply and return unless noted otherwise.
   6. Intermediate Supports: Provide for coils with finned length greater than 44-inches, with maximum spacing of 42-inches.
G. Corrosion Protection: Baked on phenolic coating suitable for 3000 hours salt spray per ASTM-B117. Heresite P413.

H. Provide structural steel support rack for each coil so that coils may be removed without disturbing other coils.

I. Cooling Coil Drain Pans: Welded 16 gauge 304 stainless steel, cross broken, double sloped to drain connections, designed to extend entire length of cooling coils including headers and return bends, minimum 2-inches deep. Bottom drain pan insulated with closed cell foam to prevent condensation below unit. Must meet ASHRAE Standard 62.1, most current edition.

J. Pipe connections on same end, extended through casing for ease of connection with plate over connection to minimize leakage.

2.7 FILTERS

A. Provide filters of the type and MERV rating or efficiency indicated on the schedule. Provide factory fabricated filter sections of the same construction and finish as the unit. Housing to accommodate filters corresponding to ASHRAE 52-76 Standards. Face loaded pre and final filters to have Type 8 frames as manufactured by AAF, FARR or equal. Side service filter sections to include hinged access doors on both sides of the unit. Air unit manufacturer to provide internal blank-offs to prevent air bypass around the filters. Filters manufactured by Farr, Purolator, AAF or equal. Provide filters in compliance with ANSI/UL 900 - Test Performance of Air Filters. Clean pressure drop not to exceed indicated pressure drop on the schedule.

B. Filter Access: Provide filters that are accessible from front or rear if indicated on drawings or to slide out when access is not available.

C. Filter Gauges: Manufacturer to provide Dwyer 2000 magnehelic gauges or equal. Magnehelic gauges to be accurate to plus or minus 2 percent of full range. One gauge to be provided for each filter bank. Provide gauges recessed into the cabinet casing.

2.8 DAMPERS

A. Performance: Maximum leakage of 5 CFM/SF at 4-inch WG differential pressure, AMCA Certified, maximum pressure rating of 13-inches WG differential pressure, maximum velocity of 6,000 fpm, -72 degrees F to 275 degrees F temperature rating.

B. Frame: 16 gauge galvanized steel, aluminum, or stainless steel channel, reinforced at corners.

C. Blades: Airfoil shaped, minimum 16 gauge galvanized steel, aluminum, or stainless steel at 6-inch maximum width. Parallel blades for outside air and return air mixing arranged to discharge against each other, opposed blade for throttling service.

D. Seals: Stainless steel compression edge seals, vinyl bulb blade seals mechanically attached.

E. Bearings: Self-lubricating stainless steel sleeve or Celcon bearing.
F. Axles: Minimum 1/2-inch plate steel, square or hexagonal shaped, mechanically attached to blade with jack-shaft assemblies for multiple dampers.

G. Actuator: Factory installed electric modulating except two-position where indicated, sized for torque required plus 25 percent, mechanical spring return mechanism, suitable for 2-10 VDC or 4-20 MA AC, UL or CSA listed, electronic current overload protection, two position indicator switches where indicated.

H. Arrange return air and minimum outside air dampers to discharge against each other for maximum mixing in the mixing box prior to the coil.

2.9 ELECTRICAL

A. Power: Provide single point power connection for three phase equipment and single point power connection for single phase equipment for each unit.

B. Provide electrical work in accordance with NEC and Division 26, Electrical. Reference Section 26 05 09, Equipment Wiring. Provide wiring, control panels and devices UL, ETL or CSA listed.

C. Fan Motor Wiring and Control: Provide wiring connections to fan motors from unit mounted variable frequency drives or starters. Mount devices in control panel inside unit service corridor or on outside of unit. Provide enclosures vented and conditioned from unit supply air. Use flexible conduits for making connections to vibration isolated equipment.

D. Provide combination starters and disconnects or variable frequency drives and disconnects for each motor as indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's written instructions and recommendations.

B. Maintain manufacturer's recommended clearances.

C. Bolt sections together with gaskets. Seal and/or fill openings between casing and AHU components and utility connections to prevent air leakage.

D. Install flexible duct connections between unit and discharge ductwork. Ensure that metal bands of connectors are parallel with minimum 1-inch flex between ductwork and fan while running.

E. Provide fixed sheaves required for final air balance.

F. Make connections to ductwork.

G. Cleaning: Prior to acceptance, thoroughly clean exposed portions of the heating, remove shipping labels and traces of foreign substance.
H. Connections: Duct installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate the general arrangement of ducts.

I. Field Quality Control:
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections. Report results in writing.
2. Perform the following field quality-control tests and inspections and prepare test reports:
   a. After installing units and after electrical circuitry has been energized, test units for compliance with requirements.
   b. Inspect for and remove shipping bolts, blocks, and tie-down straps.
   c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Remove malfunctioning units, replace with new units, and retest as specified above.

J. Startup Service:
1. Engage a factory-authorized service representative to perform startup service.
2. Protect or remove energy recovery devices prior to starting the units to ensure damage does not occur to the devices or media. Replace at no cost to Owner if devices/media get damaged or are no longer in "as-new" condition.
3. Complete installation and startup checks according to manufacturer's written instructions and do the following:
   a. Inspect for visible damage to unit casing.
   b. Inspect for visible damage to furnace combustion chamber.
   c. Inspect for visible damage to coils, energy recovery devices and fans.
   d. Inspect internal insulation.
   e. Verify that labels are clearly visible.
   f. Verify that clearances have been provided for servicing.
   g. Verify that controls are connected and operable.
   h. Verify that filters are installed.
   i. Clean furnace flue and inspect for construction debris.
   j. Connect and purge gas line.
   k. Adjust vibration isolators.
   l. Inspect operation of barometric and motorized dampers.
   m. Lubricate bearings on fan.
   n. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
   o. Adjust fan belts to proper alignment and tension.
   p. Start unit according to manufacturer's written instructions.
      1) Complete startup sheets and attach copy with Contractor's startup report.
   q. Inspect and record performance of interlocks and protective devices; verify sequences.
   r. Operate unit for an initial period as recommended or required by manufacturer.
   s. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
      1) Measure gas pressure on manifold.
2) Measure combustion-air temperature at inlet to combustion chamber.
3) Measure flue-gas temperature at furnace discharge.
5) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

t. Calibrate thermostats.
u. Adjust and inspect high-temperature limits.
v. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
w. Start system and measure and record the following:
   1) Coil leaving-air, dry- and wet-bulb temperatures.
   2) Coil entering-air, dry- and wet-bulb temperatures.
   3) Outside-air, dry-bulb temperature.
x. Inspect controls for correct sequencing of heating, mixing dampers, cooling, and normal and emergency shutdown.
y. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
   1) Supply-air volume.
   2) Return-air volume.
   3) Relief-air volume.
   4) Outside-air intake volume.

z. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:
   1) High-limit heat exchanger.
   2) Warm-up for morning cycle.
   3) Freezestat operation.
   4) Economizer to limited outside-air changeover.
   5) Alarms.

aa. After startup and performance testing, change filters, vacuum heat exchanger and coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

K. Adjusting:
   1. Adjust initial temperature, humidity, and CO2 set points.
   2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
   3. Occupancy Adjustments: Within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

L. Demonstration: Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Reference Section 01820, Demonstration and Training.

3.2 CASING

A. See General Installation Requirements above.
B. Install per manufacturer's written instructions and requirements and in accordance with specific project requirements.

### 3.3 SUPPLY RETURN AND EXHAUST FANS

A. See General Installation Requirements above.

B. Install per manufacturer's written instructions and requirements and in accordance with specific project requirements.

### 3.4 MOTOR AND DRIVE

A. See General Installation Requirements above.

B. Install per manufacturer's written instructions and requirements and in accordance with specific project requirements.

### 3.5 HYDRONIC COILS

A. See General Installation Requirements above.

B. Install per manufacturer's written instructions and requirements and in accordance with specific project requirements.

C. Water Coil Piping: Comply with applicable requirements in Division 23, HVAC. Connect to supply and return coil tappings with shutoff or balancing valve and union or flange at each connection. Provide hydronic specialties as indicated in Drawings.

D. Comb damaged and bent fins.

E. Install coils to drain in accordance with manufacturer's recommendations.

F. Install filters upstream of supply and exhaust air handler coils prior to fan operation.

G. Drain Piping: Provide trap at condensate drain; construct at least 1-inch deeper than fan pressure at coil in inches of water. Route drain to nearest drain; provide minimum 1-inch air gap. Provide trap on coil drains as detailed on Drawings.

H. Pipe drain connection to floor drain. For roof mounted units, condensate drains to discharge to roof.

I. For cooling coils, provide drain pan.

### 3.6 FILTERS

A. See General Installation Requirements above.

B. Install per manufacturer's written instructions and requirements and in accordance with specific project requirements.
3.7 DAMPERS

A. See General Installation Requirements above.

B. Install per manufacturer's written instructions and requirements and in accordance with specific project requirements.

3.8 ELECTRICAL

A. See General Installation Requirements above.

B. Install per manufacturer's written instructions and requirements and in accordance with specific project requirements.

C. Comply with applicable requirements in Division 26, Electrical Sections for power wiring, switches, and motor controls.

D. Ground equipment according to Division 26, Electrical.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION
SECTION 23 81 26
SMALL SPLIT SYSTEM AND UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY
A. Work Included: Materials, installation and testing of:
   1. Ductless Split Systems - Cooling Only
   2. Split System Condensing Unit

1.2 RELATED SECTIONS
A. Contents of Section 23 00 00, HVAC Basic Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS
A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and
   Section 01410, Regulatory Requirements.
B. In addition, meet the following:
   1. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat
      Pump Equipment.

1.4 SUBMITTALS
A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Section 01330,
   Submittal Procedures.

1.5 QUALITY ASSURANCE
A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Section
   01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
B. In addition, meet the following:
   1. Efficiency ratings, cooling/heating performance, fan performance, sound performance to
      meet or exceed Basis of Design as scheduled on Drawings.

1.6 WARRANTY
A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic
   Requirements and Section 01740, Warranties/Guaranties.
B. In addition, provide:
   1. Refrigeration compressor(s): 5-year warranty.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Ductless Split Systems:
   1. Mitsubishi
   2. Sanyo
   3. LG
   4. Friedrich
   5. Fujitsu
   6. Or approved equivalent.

B. Split System Condensing Unit:
   1. Bryant
   2. Trane
   3. York
   4. Rheem
   5. Luxaire
   6. Mitsubishi
   7. Lennox International
   8. Or approved equivalent.

2.2 DUCTLESS SPLIT SYSTEMS - COOLING ONLY

A. Description: Self-contained, matched factory-engineered and assembled. Pre-wired indoor and outdoor units. UL/ETL listed.

B. Outdoor Unit:
   1. Self contained, consisting of cabinet, compressor system, condenser fan matched to indoor unit.
   2. Cabinet: Fabricated of galvanized steel, bonderized, and finished with powder coated baked enamel.
   3. Refrigerant System:
      a. HFC refrigerant or other refrigerant with zero ozone depletion potential (ODP).
      b. Compressor: To be inverter driven, hermetic rotary type.
   4. Air System:
      a. Fan: Propeller Type with one direct drive, inverter driven, variable speed motor.
      b. Motor: Premium efficiency with inherent protection, permanently lubricated bearings and variable speed drive compatible.
      c. Coil: Copper tubes and aluminum fins, coated for corrosion protection.
   5. Controls: Single source for both indoor and outdoor units, with low/high pressure switch, capable of communicating to/from the building DDC control system.

C. Indoor Unit(s):
   1. Self contained wall mounted evaporator unit(s) matched to outdoor unit.
   2. Cabinet:
      a. Non-flammable, high impact polymer with a white finish.
b. Power Source: To be a single point power connection or sub-fed from outdoor condensing unit.

3. Refrigeration System: HFC refrigerant or other refrigerant with zero ozone depletion potential (ODP).

4. Air System:
   a. Fan: An assembly with one or two inline fan(s) with a single direct drive motor.
   b. Filter: Polypropylene, furnished with the unit, removable and washable.
   c. Coil: Direct expansion type with copper tubes mechanically bonded into aluminum fins.

5. Condensate Drain:
   a. Provide drain pan sloped to drain away from unit. Drain pan with a single drain connection.
   b. Condensate pump kit provided with unit.
   c. Secondary drain pan; Condensate overflow shut-off float switch and external alarm.

6. Controls: Wired thermostat. Control to be integral with unit.

2.3 SPLIT-SYSTEM CONDENSING UNIT

A. Description: Cooling operation, Energy Star labeled. Unit matched to indoor evaporator fan unit or low ambient operation to 40 degrees F.

B. Cabinet: Fabricated of galvanized steel and finished with powder coated baked enamel with Hail Guard.

C. Refrigeration System:
   1. HFC Refrigerant or other refrigerant with zero ozone depletion potential (ODP).
   2. Hermetically sealed compressor, high efficiency, variable speed compressor, integral high/low pressure and temperature protection, liquid line filter dryer.
   3. Options:
      a. Long line accessory kit.
      b. Solenoid valve.
      c. Crankcase heater.

D. Condenser Air System:
   1. Condenser Fan: Propeller type with direct drive motor, low sound generator, variable speed condenser fan.
   3. Condenser Coil: Copper tubes mechanically bonded into aluminum fins.
      a. Provide corrosion protection coating.
      b. Provide Hail Guard.

E. Condensate: Collection in galvanized steel drain pan sloped to drain away from the unit.

F. Controls: Completely internally wired, microprocessor, high and low pressure cutouts, contractors and internal overload protection on all motors. Provide low ambient operation to 40 degrees F outside to maintain condensing temperature on part load operation. Provide anti-short cycle timer and time delay between compressor operation.
PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install with required clearances and access for maintenance.

B. Install factory furnished devices for field installation.

C. Inspect for and remove shipping bolts, blocks and tie-down straps.

D. After energizing units: Test units for proper fan rotation. Test and adjust controls and internal safeties. Replace malfunctioning units and retest.

E. Thoroughly clean exposed portions of equipment. Install new filters prior to final test and balance and again prior to final acceptance.

F. Provide vibration isolation: As scheduled.

G. Provide seismic restraint.

H. Condensate drain per manufacturer's piping diagram.

I. Condensate piped to indirect waste connection; cleanouts at changes of direction; sized and sloped to drain per Code. Secondary drain routed to visible location.

J. Shut-off/hose kits for all hydronic connections.

END OF SECTION
SECTION 26 00 00

ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:
   1. Provide: To furnish and install, complete and ready for intended use.
   2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
   3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
   4. Or Equal: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Section 01330, Submittal Procedures, and approved by the Engineer prior to submitting bids for substituted items.
   5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 26, Electrical Contract Documents.

B. Related Work:
   1. Additional conditions apply to this Division including, but not limited to:
      a. Specifications
      b. Drawings
      c. Addenda
      d. Owner/Architect Agreement
      e. Owner/Contractor Agreement
      f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Section 01410, Regulatory Requirements, individual Division 26, Electrical Sections and those listed in this Section.
B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
   1. State of California:
      a. CBC - California Building Code
      b. CEC - California Electrical Code
      c. CEC T24 - California Energy Code Title 24
      d. CFC - California Fire Code
      e. CMC - California Mechanical Code
      f. CPC - California Plumbing Code
      g. CSFM - California State Fire Marshal
      h. DSA - Division of State Architect Regulations and Requirements
   C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
      1. ABA - Architectural Barriers Act
      2. ADA - Americans with Disabilities Act
      3. ANSI - American National Standards Institute
      4. APWA - American Public Works Association
      5. ASCE - American Society of Civil Engineers
      6. ASHRAE Guideline 0, the Commissioning Process
      7. ASTM - ASTM International
      8. CFR - Code of Federal Regulations
      9. EPA - Environmental Protection Agency
      10. ETL - Electrical Testing Laboratories
      11. FCC - Federal Communications Commission
      12. FM - FM Global
      13. IBC - International Building Code
      14. IEC - International Electrotechnical Commission
      15. IEEE - Institute of Electrical and Electronics Engineers
      16. IES - Illuminating Engineering Society
      17. ISO - International Organization for Standardization
      18. MSS - Manufacturers Standardization Society
      19. NEC - National Electric Code
      20. NECA - National Electrical Contractors Association
      21. NEMA - National Electrical Manufacturers Association
      22. NETA - National Electrical Testing Association
      23. NFPA - National Fire Protection Association
      24. OSHA - Occupational Safety and Health Administration
      25. UL - Underwriters Laboratories Inc.
   D. See Division 26, Electrical individual Sections for additional references.
   E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
F. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

1.4 SUBMITTALS

A. See Section 01330, Submittal Procedures as well as individual Division 26, Electrical Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:
   1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
   2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each Specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
   3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.
   4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
      a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
      b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.
      c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.
   5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Structural documents.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.

9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10. Substitutions and Variation from Basis of Design:
   a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
   b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or equal", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
   c. Provide and maintain marked up plans at the job site at all times.

11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.
   a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:
   a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
   b. Resubmit for review until review indicates no exception taken or "make corrections as noted".

14. Operation and Maintenance Manuals, Owners Instructions:
a. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.

2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.

3) Include Warranty per Section 01740, Warranties/Guaranties, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

4) Include product certificates of warranties and guarantees.

5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.

6) Include commissioning reports.

7) Include copy of startup and test reports specific to each piece of equipment.

8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.

c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:

a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.

c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.

d. See Division 26, Electrical individual Sections for additional items to include in record drawings.
1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations.

B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

E. Provide products that are UL listed.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Section 01740, Warranties/Guaranties, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Section 01740, Warranties/Guaranties. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prepare and submit coordinated layout drawings (composite drawings), prior to construction, to coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including plumbing, fire protection, electrical, ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Section 01311, Project Management and Coordination, and/or Division 23, HVAC to combine information furnished by other trades into master coordination documents.

B. Prepare Drawings as follows:
1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.

2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.

3. Incorporate Addenda items and change orders.

4. Provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Verify in field exact size, location, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide like items from one manufacturer.

2.2 MATERIALS

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and city authorities. Equipment(fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.

B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

D. Hazardous Materials:

1. Comply with local, State of California, and Federal regulations relating to hazardous materials.

2. Comply with Section 01412, Hazardous Materials, for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.
PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A., Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:
   1. Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
      a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
      b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
      c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:
   1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
      a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums:
   1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.
G. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

H. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Structural documents, and individual Division 26 Electrical Sections.

B. General:
   1. Earthquake resistant designs for Electrical (Division 26) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.
   2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
   3. Provide stamped shop drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.
   4. Provide stamped shop drawings from licensed Structural Engineer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.
   5. Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Section 01400, Quality Control Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
   1. Underground conduit installation prior to backfilling.
   2. Prior to covering walls.
   3. Prior to ceiling cover/installation.
   4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:
   1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems’ installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer’s acceptance that the electrical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.
3. Provide necessary tools for testing and access as requested by the District.

3.4 CONTINUITY OF SERVICE

A. Comply with individual Division 26, Electrical Sections and the following:
   1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.
   2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.
   3. Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
      a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
   4. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.
      a. Organize work to minimize duration of power interruption.
      b. Coordinate utility service outages with utility company.

3.5 CUTTING AND PATCHING

A. Confirm requirements in Section 01730, Cutting and Patching, and individual Division 26, Electrical Sections and the following:
   1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
   2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
   3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
   4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Section 00700, General Conditions. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.

2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3. Protect bus duct and similar items until in service.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Section 01770, Contract Closeout Procedures, Articles 1.12, 1.13, and 1.14, and individual Division 26, Electrical Sections.

B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Section 01770, Contract Closeout Procedures, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

A. Confirm Cleaning requirements in Section 01710, Cleaning Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.
3.10 INSTALLATION

A. Confirm Installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

A. Confirm requirements in Division 09, Finishes. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
   1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
   2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
   3. See individual equipment Specifications for other painting.
   4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
   5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
   6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

A. Confirm requirements in Section 01770, Contract Closeout Procedures. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
   1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
      a. Cleaning
      b. Operation and Maintenance Manuals
      c. Training of Operating Personnel
      d. Record Drawings
      e. Warranty and Guaranty Certificates
      f. Start-up/Test Document and Commissioning Reports
3.13 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Tests:
   1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
   2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Electrical items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 SALVAGED EQUIPMENT AND RECYCLED MATERIAL

A. Salvage the following equipment not being reused and return to Owner. Remove from site and dispose if rejected by Owner.
   1. Luminaires
   2. Breakers

B. Electrical equipment that cannot be salvaged for reuse, sell/give to recycling company. Recycle following excess, removed, or demolished electrical material:
   1. Copper or aluminum conductors, buses, and motor/transformer windings.
   2. Steel and aluminum from raceways, boxes, enclosures, and housings.
   3. Acrylic and glass from luminaire lenses/refractors.

C. Provide separate on-site storage space for recycled and salvaged material. Clearly label space.

D. Confirm additional salvaged equipment and recycled materials in the Contract Documents.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Equipment connections, whether furnished by Owner or other Divisions of the Contract.
   2. Equipment grounding.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition:
   1. Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Equipment for Equipment Wiring: As specified in individual Sections.

2.2 GENERAL

A. Unless otherwise noted, the following voltage and phase characteristics apply to motors:
   1. 3/4 HP and Under: 120 volt, 1 phase.
   2. 1 HP and Over: 480 volt, 3 phase.
B. Safety Switches: Provide as required by CEC and as specified in Section 26 28 16, Enclosed Switches and Circuit Breakers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Owner and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Owner and equipment furnished under the following divisions of work under this contract:

1. Division 8, Openings
2. Division 11, Equipment
3. Division 14, Conveying Equipment
4. Division 21, Fire Suppression
5. Division 22, Plumbing
6. Division 23, HVAC, Heating, Ventilating and Air Conditioning
7. Division 27, Communications
8. Division 28, Electronic Safety and Security

3.2 INSTALLATION

A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Engineer.

B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.

C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.

D. Install motor starters and controllers for equipment furnished by others.

E. Appliance/Utilization Equipment:
   1. Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Provide receptacle configured to receive cord cap.
   2. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering wiring devices and coverplates.

F. Furniture Partitions:
   1. Provide liquid-tight flexible connections from wall or floor outlet as shown on Drawings with pull string. Provide handle-tie breakers for simultaneous disconnecting of power by branch circuit breakers for multi-wire branch circuits. Provide connection to furniture as directed by shop drawings for owner furnished furniture partitions.
   2. Splice incoming wiring for phases, neutral and ground to the power feed connection provided for the furniture partition system so that no outlets are non-functioning at completion of work.
3. Coordination with Division 08, Openings and Drawing requirements.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400, Quality Control Requirements.

3.4 SYSTEMS STARTUP

A. Provide field representative to prepare and start equipment.
   1. Test and correct for proper rotation of polyphase motors.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION
SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
1. Lugs and Pads
2. Wires and Cables
3. Connectors

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
1. Cable insulation test reports in project closeout documentation.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lugs and Pads:
1. Anderson
2. Ilsco
3. Panduit
4. Thomas & Betts
5. 3M
6. Or equal.

B. Wires and Cables:
   1. General
      a. General Cable
      b. Okonite
      c. Southwire
      d. Or equal.

   C. Connectors:
      1. Anderson Power Products
      2. Burndy
      3. Ilsco
      4. 3M
      5. Thomas & Betts
      6. Or equal.

2.2 LUGS AND PADS

   A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

   B. Copper Pads: Drilled and tapped for multiple conductor terminals.

   C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

2.3 WIRES AND CABLES

   A. Copper, 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid or stranded. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THWN-2, XHHW-2 or THHN-2.

   B. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.

   C. Color Code Conductors as Follows:

<table>
<thead>
<tr>
<th>PHASE</th>
<th>208 VOLT WYE</th>
<th>480 VOLT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Black</td>
<td>Brown</td>
</tr>
<tr>
<td>B</td>
<td>Red</td>
<td>Orange</td>
</tr>
<tr>
<td>C</td>
<td>Blue</td>
<td>Yellow</td>
</tr>
<tr>
<td>Neutral</td>
<td>White</td>
<td>Gray or White</td>
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<tr>
<td></td>
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<tr>
<td>Ground</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Isolated Ground</td>
<td>Green w/yellow trace</td>
<td>N/A</td>
</tr>
</tbody>
</table>

D. MC Cable: Not allowed.
E. AC Cable (Armored Cable): Not allowed.

F. NMB Cable: Not allowed.

G. SO Cord: Annealed copper conductors, 600 volt rated. Minimum size No. 12 AWG with ground wire. Maximum of six conductors and ground per cable. 90 degrees C rated thermoset jacket.

2.4 CONNECTORS

A. Split bolt connectors not allowed.

B. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer instructions and CEC.

B. Field Quality Control:
   1. Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Architect if insulation resistance is less than 1 megohm.
   2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit test reports with project closeout documents.
   3. Inspect and test in accordance with NETA Standard ATS, except Section 4.
   4. Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

3.2 LUGS AND PADS

A. Thoroughly clean surfaces to remove all dirt, oil, great or paint.

B. Use torque wrench to tighten per manufacturer's directions.

3.3 WIRES AND CABLES

A. General:
   1. Do not install or handle thermoplastic insulated wire and cable in temperatures below +14 degrees F (-10 C).
   2. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
   3. Install conductors with care to avoid damage to insulation.
4. Do not apply greater tension on conductors than recommended by manufacturer during installation.

5. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.

6. Conductor Size and Quantity:
   a. Install no conductors smaller than 12 AWG unless otherwise shown.
   b. Provide required conductors for a fully operable system.

7. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits.

8. Conductors in Cabinets:
   a. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
   b. Tie and bundle feeder conductors in wireways of panelboards.
   c. Hold conductors away from sharp metal edges.

9. Homeruns:
   a. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.

10. Identify wire and cable under the provisions of Section 26 05 53, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.

11. Exposed cable is not allowed.

3.4 CONNECTORS

A. Install to assure a solid and safe connection.

END OF SECTION
SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Grounding Electrodes
   2. Connectors and Accessories
   3. Grounding Busbar
   4. Grounding Conductor

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Test reports of ground resistance for service and separately derived system grounds.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Comply with the requirements of ANSI/NFPA 70.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guarantees.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Grounding Electrodes:
   1. Erico
   2. Thomas & Betts
3. Talley
4. Or equal.

B. Connectors and Accessories:
   1. Burndy Hyground Compression System
   2. Erico/Cadweld
   3. Amp Ampact Grounding System
   4. Pipe Grounding Clamp:
      a. Burndy GAR Series
      b. O Z Gedney
      c. Thomas & Betts
      d. Or equal.

C. Grounding Busbar:
   1. Chatsworth
   2. Erico
   3. Schneider Electric/Square D
   4. Panduit
   5. Or equal.

D. Grounding Conductor
   1. General Cable
   2. Okonite
   3. Southwire
   4. Or equal.

2.2 GROUNDING ELECTRODES
   A. Ground Rods: Copper-clad steel, minimum 3/4-inch diameter, 10-feet long, tapered point, chamfered top.

2.3 CONNECTORS AND ACCESSORIES
   A. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors.

   B. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe.

2.4 GROUNDING BUSBAR
   A. Grounding Busbar: 1/4-inch thick by 4-inch high by 10-inch long copper grounding busbar with insulators that meet ANSI J-STD-607-A specifications. UL 467 listed. Hole patterns in busbar to accommodate two-hole lugs, four-hole configuration.

2.5 GROUNDING CONDUCTOR
   A. Grounding Electrode Conductor: Soft-draw bare stranded copper for wire sizes larger than #10 AWG Bare. Solid copper for wire sizes #10 AWG and smaller.
B. Equipment Grounding Conductor: Green insulated, insulation type to match that of associated feeder or branch circuit wiring, size as indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verify site conditions prior to beginning work.

B. Separately Derived Systems: Ground each separately derived system per NEC Article 250.

C. Bond together reinforcing steel and metal accessories in pool and fountain structures.

D. Corrosion inhibitors: Apply a corrosion inhibitor to contact surfaces when making grounding and bonding connections. Use corrosion inhibitor appropriate for protecting a connection between metals used.

E. Grounding system resistance to ground not to exceed 25 ohms. Make necessary modifications or additions to grounding electrode system for compliance. Submit final tests to assure that this requirement is met.

F. Resistance of grounding electrode system: measure using a four-terminal fall-of-potential method as defined in IEEE 81. Take ground resistance measurements before electrical distribution system is energized and in normally dry conditions, not less than 48 hours after last rainfall. Take resistance measurements of separate grounding electrode systems before systems are bonded together below grade. Combined resistance of separate systems may be used to meet required resistance, but specified number of electrodes must still be provided.

G. Inspect and test in accordance with NETA Standard ATS, Except Section 4.

H. Perform inspections and tests listed in NETA Standard AB, Section 7.13.

3.2 GROUNDING ELECTRODES INSTALLATION

A. Ground Rod Electrode:
   1. Verify that final backfill and compaction have been completed before driving rod electrodes.
   2. Tap at center ground rod and extend grounding electrode conductor to service grounding bus. Install grounding electrode conductor to service grounding bus in rigid PVC conduit for physical protection where grounding electrode conductor passes through concrete floor or other concrete structure.

B. Metal Underground Water Service: Bond water service pipe to service equipment ground bus or to the grounding electrode system. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.

C. Bond together metal siding not attached to grounded structure; bond to grounding electrode system.
3.3 CONNECTORS AND ACCESSORIES INSTALLATION

A. Install per manufacturer's instructions.

3.4 GROUNDING BUSBAR INSTALLATION

A. Install per manufacturer's instructions.

3.5 GROUNDING CONDUCTOR INSTALLATION

A. Raceways:
   1. Ground metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger equipment grounding conductor is included with circuit, use grounding bushing with lay-in lug.
   2. Connect metal raceways, which terminate within an enclosure but without mechanical connection to enclosure, by grounding bushings and ground conductor to grounding bus.
   3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.
   4. Install equipment grounding conductor, code size minimum unless noted on drawings, in metallic and nonmetallic raceway systems.

B. Feeders and Branch Circuits:
   1. Provide continuous green insulated copper equipment grounding conductors for feeders and branch circuits.
   2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment grounding conductors for feeders and branch circuits sized in accordance with the latest adopted edition of NEC Article 250, Table 250-122.

C. Bond boxes, cabinets, enclosures and panelboard equipment grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.

D. Motors, Equipment and Appliances: Install code size equipment grounding conductor to (motor) equipment frame or manufacturer's designated ground terminal.

E. Receptacles: Connect ground terminal of receptacle and associated outlet box to equipment grounding conductor. Self grounding nature of receptacle devices does not eliminate equipment grounding conductor bolted to outlet box.

F. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Use #2 AWG bare copper conductor.

END OF SECTION
SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Anchors, Threaded Rod and Fasteners
   2. Support Channel, Hangers and Supports
   3. Rooftop Conduit Supports

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
   2. Support systems to be supplied by a single manufacturer.
   3. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
      a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.
1.7 PERFORMANCE REQUIREMENTS

A. General: Provide conduit and equipment hangers and supports in accordance with the following:
   1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.
   2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of California.
   1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.
   2. Equipment and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.

D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.

E. Provide seismic restraint hangers and supports for conduit and equipment.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Anchors, Threaded Rod and Fasteners:
   1. Anchor It
   2. Epcon System
   3. Hilti-Hit System
   4. Power Fast System
   5. Or equal.

B. Support Channel, Hangers and Supports:
   1. B-Line
   2. Kindorf
   3. Superstrut
   4. Unistrut
   5. Or equal.

C. Rooftop Conduit Supports:
   1. Cooper B-Line Dura-Block Rooftop Support Base
   2. Or equal.
2.2 ANCHORS, THREADED ROD AND FASTENERS

A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.

C. Anchors and Fasteners:
   1. Do not use powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts.
   3. Steel Structural Elements: Use beam clamps.
   7. Sheet Metal: Use sheet metal screws.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS

A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
   2. Coating: Hot dip galvanized.

B. Pipe Straps: Two-hole galvanized or malleable iron.

C. Luminaire Chain: 90 lb. test with steel hooks.

D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsible for their design.
   1. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
E. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or equal.

F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.4 ROOFTOP CONDUIT SUPPORTS

A. Curb base made of 100 percent recycled rubber and polyurethane prepolymer with a uniform load.

B. Capacity of 500 pounds per linear foot of support.

C. UV resistant.

D. Steel Frame: Steel, 14 gauge strut galvanized per ASTM A653 or 12 gauge strut galvanized per ASTM A653 for bridge series.

E. Continuous block channel supports with 1-inch gaps to allow water flow, bridge channel supports, extendable height channel supports and elevated single conduit supports.

F. Attaching Hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633 fastened directly into rubber material with weather resistant Type 12 lag screws.

G. Provide load distribution plates when required for heavy loads.

H. Finish: Black with safety yellow striping.

I. Provide hot dipped galvanized components for items exposed to weather.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Fabrication - Miscellaneous Metals

1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
2. Finishes:
   a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
   b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
   c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.2 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

A. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.

B. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.

C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

D. Do not use supports or fastening devices to support other than one particular item.

E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.

F. Provide seismic bracing per CBC requirements.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors.

H. Use spring lock washers under fastener nuts for strut.

I. Cutting and Drilling
   1. Do not drill or cut structural members without prior permission from Architect.

3.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

B. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
C. Verify mounting height of luminaires prior to installation when heights are not detailed.

D. Install vertical support members for equipment and luminaires, straight and parallel to building walls.

E. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.

F. Provide independent supports to structural member for luminaires, materials, or equipment installed in or on ceilings, walls or in void spaces or over suspended ceilings.

G. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.

H. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

I. Do not use supports or fastening devices to support other than one particular item.

J. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by CEC.

K. Maximum distance between supports not to exceed 8 foot spacing unless otherwise required by CEC.

L. Support flexible conduits and metal clad cable within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by CEC.

M. Maximum distance between supports for flexible conduits and metal clad cable not to exceed 48-inches spacing unless otherwise required by CEC.

N. Maximum distance between supports for rigid PVC conduits unless otherwise required by CEC is as follows:
   1. 1/2-inch or 3/4-inch and 1-inch conduit, 3-feet apart.
   2. 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.
   3. 2-1/2-inch and 3-inch conduit, 5-feet apart.
   4. 4-inch and 5-inch conduit, 6-feet apart.
   5. 6-inch conduit, 7-feet apart.

O. Maximum distance between supports for auxiliary gutters and wireways unless otherwise required by CEC is as follows:
   1. Sheet metal auxiliary gutters and wireways - 4-feet apart horizontally and 10-feet vertically.
   2. Non-metallic auxiliary gutters and wireways - 30-inches apart horizontally and 3-feet vertically.

P. Install strut hangers as instructed by strut manufacturer. Suspend strut hangers as instructed by strut manufacturer for the load, with a maximum spacing of 8-feet on center and within 2-feet of outlet box, cabinet, junction box or other channel raceway termination unless otherwise required by CEC.
Q. Coordinate routing of conduit racks with materials and equipment installed by other trades. Where conduit racks are exposed to view, coordinate location and installation with Architect for optimal appearance.

R. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.

S. Provide seismic bracing per CBC requirements.

T. Install surface-mounted cabinets and panelboards with minimum of four anchors.

U. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

V. Wet and Damp Locations:
   1. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-inch off wall.

3.4 ROOFTOP CONDUIT SUPPORTS INSTALLATION

A. Consult roofing manufacturer for roof membrane compression capacities. If necessary, provide a compatible sheet of roofing material (rubber pad) under rooftop support to disperse concentrated loads and add further membrane protection.

B. Do not use supports that will void roof warranty.

C. Install supports per manufacturer's instructions and recommendations.

D. Use properly sized clamps to suit conduit sizes.

E. Install supports for rooftop raceways to raise raceways a minimum of 4-inches above the roof structure unless otherwise noted.

END OF SECTION
SECTION 26 05 33

RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Rigid Metal Conduit (RMC)
   2. Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Metal Conduit
   3. Electrical Metallic Tubing (EMT)
   4. Flexible Metal Conduit (FMC)
   5. Liquidtight Flexible Metal Conduit (LFMC)
   6. Electrical Polyvinyl Chloride (PVC) Conduit
   7. Conduit Fittings
   8. Surface Raceway Systems

B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on drawings and described in these specifications.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

B. In addition, reference the following:
   1. Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment
   2. Section 26 05 34, Boxes
   3. Section 26 05 43, Electrical Vaults and Underground Raceways

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.
1.7 DEFINITIONS

A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Rigid Metal Conduit (RMC):
   1. Allied Tube & Conduit
   2. Beck Manufacturing Inc.
   3. Picoma
   4. Wheatland Tube Company
   5. Or equal.

B. Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit:
   1. Allied Tube & Conduit
   2. Thomas & Betts Corporation
   3. Robroy Industries
   4. O'kote Inc.
   5. Or equal.

C. Electrical Metallic Tubing (EMT):
   1. Allied Tube & Conduit
   2. Beck Manufacturing WL
   3. Picoma
   4. Wheatland Tube Company
   5. Or equal.

D. Flexible Metal Conduit (FMC):
   1. AFC Cable Systems Inc.
   2. Electri-Flex Company
   3. International Metal Hose
   4. Or equal.

E. Liquidtight Flexible Metal Conduit (LFMC):
   1. AFC Cable Systems Inc.
   2. Electri-Flex Company
   3. International Metal Hose
   4. Or equal.

F. Electrical Polyvinyl Chloride (PVC) Conduit:
   1. AFC Cable Systems Inc.
   2. Electri-Flex Company
   3. International Metal Hose
   4. JM Eagle
5.  Or equal.

G.  Conduit Fittings:
   1.  Bushings:
       a.  Insulated type for Threaded Rigid or EMT without Factory Installed Plastic Throat
           Conductor Protection:
           1)  Thomas & Betts 1222 Series
           2)  O-Z Gedney B Series
           3)  Or equal.
   2.  Raceway Connectors and EMT Couplings:
       a.  Thomas & Betts Series
       b.  O-Z Gedney Series
       c.  Or equal.
   3.  Expansion/Deflection Fittings:
       a.  EMT: O-Z Gedney Type TX
       b.  RMC: O-Z Gedney Type AX, DX and AXDX, Crouse & Hinds XD
       c.  PVC: O-Z Gedney Type DX with PVC adapters, Carlon E945 Series, Kraloy
           OPEJ Series
       d.  Or equal.

H.  Surface Raceway Systems:
   1.  Single Channel Surface Raceway and Signal:
       a.  Wiremold 3000 Series
       b.  MonoSystems SMS 3000 Series
       c.  Or equal.
   2.  Two Channel Surface Raceway:
       a.  Wiremold 4000 Series
       b.  MonoSystems SMS 4200 Series
       c.  Or equal.

2.2  RIGID METAL CONDUIT (RMC)

A.  UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.
    1.  Fittings: NEMA FB2.10.

2.3  POLYVINYL CHLORIDE (PVC) EXTERNALLY COATED GALVANIZED RIGID
     METAL CONDUIT

A.  Description: UL 6, ANSI C80.1, and NEMA RN 1; rigid steel conduit with external PVC
    coating.
    1.  PVC Coating: Minimum 40 mils in thickness.

B.  Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match
    conduit.

2.4  ELECTRICAL METALLIC TUBING (EMT)

A.  Description: UL 797, ANSI C80.3; steel galvanized tubing.

B.  Fittings: NEMA FB 1; steel, compression type.
2.5 **FLEXIBLE METAL CONDUIT (FMC)**

A. **Description:** UL 1, Interlocked steel construction.

B. **Fittings:** NEMA FB 2.20.

2.6 **LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)**

A. **Description:** UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes to have a square lock core and contain an integral bonding strip of copper. 1-1/2-inch and larger to have fully interlocked core. Jacket material to be moisture, oil and sunlight resistant flexible PVC.

B. **Fittings:** NEMA FB 2.20.

2.7 **ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT**

A. **Description:** UL 651, NEMA TC 2; Schedule 40 PVC.

B. **Fittings:** NEMA TC 3.

2.8 **CONDUIT FITTINGS**

A. **Bushings:**
   1. Insulated type for Threaded Rigid, IMC Conduit or Raceway Connectors without factory-installed plastic throat conductor protection.
   2. Insulated grounding type for Threaded Rigid, IMC Conduit and Conduit Connectors.

B. **Raceway Connectors and EMT Couplings:**
   1. Steel connectors, couplings, and conduit bodies, hot-dip galvanized.
   2. Connector locknuts to be steel, with threads meeting ASTM tolerances. Locknuts to be hot-dip galvanized.
   3. Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) to have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation to bear only on plastic throat insert.
   4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.
   5. Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.

C. **Provide expansion/deflection fittings for EMT.**

2.9 **SURFACE RACEWAY SYSTEMS**

A. **Single Channel Surface Raceway:**
   1. **Power:** Provide 20 amp multi-outlet assembly as indicated on drawings.
   2. **Signal:** Blank cover with outlets as indicated on drawings.
B. Two Channel Surface Raceway: One channel for power, other channel for signal. Provide 20 amp multi-outlet assembly as indicated on drawings. Provide divider between channels.

C. Provide lengths scaled from drawings to tolerance of 1/2-inch, over raceway length, between end wall surface. Do not scale from Division 26, Electrical Drawings.

D. Provide prewired receptacles every 24-inches unless otherwise noted on drawings. Reference Section 26 27 26, Wiring Devices for device requirements.

E. Provide end caps, corner joints, tees, transition fittings, device brackets and like items for complete installation.

F. Verify exact mounting height with drawings.

G. Finish White.

H. Basis of Design: Surface raceway design, shown on the drawings, is based on Wiremold product line. Approved manufacturers listed are allowed on condition of meeting the specified conditions including area of fill, finish and coordination with other trades. Remove and replace raceway not meeting these conditions at no cost to Owner.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect.

B. Conduit Size:
   1. Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.

C. Underground Installations:
   1. More than 5-feet from Foundation Wall: Use PVC.
   2. Within 5-feet from Foundation Wall: Use PVC coated RMC.
   3. In or Under Slab on Grade: Use PVC.

D. In Slab Above Grade:
   1. Use PVC.
   2. Maximum Size Conduit in Slab: Contact Structural Engineer for maximum outside diameter of conduit.

E. Provide two pull strings/tapes in empty conduits. Types:
   1. Utility Company Conduit: Polyester measure/pulling tape, Greenlee 4436 or equal. Coordinate exact requirements with utility company.
   2. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.
   3. Branch Circuits and Low Voltage: Greenlee Poly Line 431 or approved.
4. If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.
5. Secure pull string/tape at each end.
6. Provide caps on ends of empty conduit to be used in future.
7. Label both ends of empty conduits with location of opposite end.

F. Elbows: Use fiberglass or PVC coated RMC for underground installations.


H. Verify that field measurements are as shown on drawings.

I. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.

J. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:
   1. Where shown on the structural drawings.
   2. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

K. Verify routing and termination locations of conduit prior to rough-in.

L. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

M. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.

N. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.

O. Install nonmetallic conduit in accordance with manufacturer's instructions.

P. Inserts, anchors and sleeves.
   1. Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.
   2. Coordinate location of sleeves with consideration for other building systems prior to concrete pour.

Q. Conduit Supports:
   1. Arrange supports to prevent misalignment during wiring installation.
   2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
   3. Group related conduits; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional conduits.
   4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
   5. Do not attach conduit to ceiling support wires.
R. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.

S. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.

T. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.

U. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.

V. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.

W. Keep 277/480 volt wiring independent of 120/208 volt wiring. Keep power wiring independent of communication system wiring.

X. Keep emergency system wiring independent of other wiring systems per NEC 700.

Y. Installation of conduit in structural concrete that is less than 3-inches thick is prohibited without the approval of the Structural Engineer. Maintenance pads, and curbs are exempted.

Z. Raceways Embedded in Floor Slabs:
1. Do not install raceways in slab without the approval of the Structural Engineer.
2. Do not let raceways interfere with placement of floor slab reinforcement components.
3. Install raceways between the upper and the lower layers of reinforcing steel.
4. Space raceways not less than 8-inches on centers except where they converge at panels or junction boxes.
5. Raceways running parallel to slabs supports, such as beams, columns and structural walls, to be installed not less than 12-inches from such supporting elements.
6. Branch circuit homeruns are not permitted in slab, route branch circuit homeruns above grade exposed in approved areas or above lay-in ceiling spaces.
7. Route conduits in or under slabs point-to-point.
8. Do not cross conduits in slab.
9. Encase medium voltage feeder conduits using red concrete.

AA. Arrange conduit to maintain headroom and present neat appearance.

AB. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.

AC. Exposed conduits are permitted only in following areas:
1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
2. Existing walls that are concrete or block construction.
3. Where specifically noted on Drawings.
4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.
AD. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.

AE. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.

AF. Below Grade Conduit:
   1. See 26 05 43, Electrical Vaults and Underground Raceways.
   2. Use PVC, PVC coated RMC, or fiberglass conduit.
   3. Provide watertight conduit sleeves and rubber seals for conduit entering building below grade, Link-Seal system by Thunderline Corporation or equal.

AG. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

AH. Maintain adequate clearance between conduit and piping.

AI. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.

AJ. Cut conduit square using saw or pipecutter; deburr cut ends.

AK. Bring conduit to shoulder of fittings; fasten securely.

AL. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.

AM. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.

AN. Use hydraulic one shot bender to fabricate elbows for bends in metal conduit larger than 2-inch size.

AO. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

AP. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

AQ. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.

AR. Feeders: Do not combine or change feeder runs.

AS. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

AT. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation and installer.

### 3.2 RIGID METAL CONDUIT (RMC) INSTALLATION

A. Outdoor Locations Above Grade: RMC.
B. Damp Locations: RMC up to 2-inches in diameter.

C. Dry Locations:
   1. Concealed: RMC.
   2. Exposed: RMC.

D. Dry, Protected: RMC.

E. In areas exposed to severe mechanical damage: RMC.

F. For security conduits installed exposed and subject to tampering: RMC.

3.3 POLYVINYL CHLORIDE (PVC) EXTERNALLY COATED GALVANIZED RIGID METAL CONDUIT INSTALLATION

A. Use PVC coated RMC 36-inch radius ells for power service conduits and 48-inch radius ells for telephone service conduits.

3.4 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION

A. Damp Locations: EMT up to 2-inches in diameter.

B. Dry Locations:
   1. Concealed: EMT.
   2. Exposed: EMT.

C. Dry, Protected: EMT.

3.5 FLEXIBLE METAL CONDUIT (FMC) INSTALLATION

A. Dry Locations: Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.

B. Install 12-inch minimum slack loop on flexible metallic conduit.

3.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION

A. Use PVC coated liquidtight flexible metallic conduit for motors and equipment connections subject to movement or vibration and subjected to any of following conditions: Exterior location, moist or humid atmosphere, corrosive environments, water spray, oil, or grease.

B. Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

3.7 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Provide equipment grounding conductor in PVC conduit runs containing power conductors.

C. Underground Installation:
   1. Areas subject to vehicular traffic: Schedule 80 PVC.
2. Other underground applications: Schedule 40 PVC, except where prohibited by the NEC or local codes.

D. Convert PVC conduit to Rigid Metal Conduit (RMC) prior to emerging from underground, concrete encasement, or concrete slab.

E. Provide expansion fittings to compensate for expansion and contraction per NEC 352.44.

F. PVC elbows are not acceptable. Use fiberglass or PVC coated RMC.

G. Trim cut ends inside and outside to remove rough edges.

H. Provide bushings when entering a box, fitting or other enclosure.

3.8 CONDUIT FITTINGS INSTALLATION

A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC and IMC. Seal conduits where penetrating below raised floor area.

B. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

C. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.

D. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.

E. Use threaded type fittings in wet locations, hazardous locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.

F. Use PVC coated, threaded type fittings in corrosive environments.

G. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.

H. Condulets and Conduit Bodies:
   1. Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger, or for conductor splicing.

I. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.
J. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

3.9 SURFACE RACEWAY SYSTEMS INSTALLATION

A. Install per manufacturer's installation instructions, perpendicular and parallel to building lines.

B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.

C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

D. Close end of wireway and unused conduit openings.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Outlet Boxes
   2. Floor Boxes
   3. Pull and Junction Boxes
   4. Box Extension Adapter
   5. Weatherproof Outlet Boxes

B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

B. In addition, reference the following:
   1. Section 26 05 33, Raceways
   2. Section 26 05 53, Identification for Electrical Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Outlet Boxes:
   1. Hubbell
2. Thomas & Betts
3. Eaton/Crouse-Hinds
4. Or approved equivalent.

B. Floor Boxes:
1. Legrand (Wiremold)
2. FSR
3. Hubbell
4. Thomas & Betts
5. MonoSystems
6. Eaton/Crouse-Hinds
7. Or approved equivalent.

C. Pull and Junction Boxes:
1. Eaton/Crouse-Hinds
2. Hoffman
3. Or approved equivalent.

D. Box Extension Adapter:
1. Hubbell
2. Thomas & Betts
3. Eaton/Crouse-Hinds
4. Or approved equivalent.

E. Weatherproof Outlet Boxes:
1. Legrand (Pass & Seymour)
2. Hubbell
3. Thomas & Betts
4. Eaton/Crouse-Hinds
5. Intermatic
6. Or approved equivalent.

2.2 OUTLET BOXES

A. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.

B. Device Outlet: Installation of one or two devices at common location, minimum 4-inches square, minimum 1-1/2-inches deep for non-USB type devices. Installation of one or two devices at common locations, minimum 4-inches square, minimum 2-inches deep for USB type devices. Single- or two-gang flush device raised covers.

C. Telecom Outlet: Provide 4-inches square, minimum 2-1/8-inch deep box with two-gang plaster ring. Provide under provisions of Division 27, Communications.

D. Multiple Devices: Three or more devices at common location. Install one-piece gang boxes with one-piece device cover. Install one device per gang.

E. Masonry Boxes: Outlets in concrete.
F. Construction: For interior locations, provide galvanized steel outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. All surface mounted outlet boxes are to be drawn. Welded boxes are not acceptable.

G. Accessories: Provide outlet box accessories for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

H. Noise Control: Provide acoustic putty pad to back side of each outlet box installed in acoustic rated walls.

2.3 FLOOR BOXES

A. Basis of Design: Floor boxes are based on Legrand/Wiremold as the manufacturer. Manufacturers are approved for use on this project on condition of meeting or exceeding basis of design for conditions of use, box capacity, total allowed connecting conduit capacity, and available finishes. Products ordered or installed not meeting basis of design are subject to removal and replacement at no cost to Owner.

B. Floor Boxes:

1. Multi-Gang Box, Slab on Grade: Cast iron housing rated for slab on grade application, fully adjustable, accepts up to 1.25-inch conduits. Rubber gasket protects interior from water and debris. 4-gang. Provide with one (1) or two (2) duplex receptacle(s) and activations for one (1) telecom/AV outlets. Rectangular activation, flanged, for use with matching carpet or tile insert. Finish: aluminum. Legrand/Wiremold RFB2-OG or approved.

2. Multi-Gang Box, Slab above Grade: Steel housing rated for fire rated slab above grade application, fully adjustable, accepts up to 1.25-inch conduits, fire rated for 2-hours. Rubber gasket protects interior from water and debris. 4-gang. Provide with one (1) or two (2) duplex receptacle(s) and activations for one (1) telecom/AV outlets. Rectangular activation, flanged, for use with matching carpet or tile insert. Finish: aluminum. Legrand/Wiremold EFB45-FC or approved.

3. Face-Up Floor Box, Slab on Grade: Cast-iron housing rated for slab on grade application, fully adjustable, accepts up to 1.25-inch for power and 2-inch for telecom. Rubber gasket protects interior from water and debris. 2-gang or as noted on drawings. Provide with one (1) or two (2) duplex receptacle(s). Rectangular activation, flanged with Decora style flip cover. Finish: aluminum. Legrand/Wiremold 880CM series or approved.

4. Face-Up Floor Box, Slab above Grade: Steel housing rated for fire rated slab above grade application, fully adjustable, accepts up to 1.25-inch for power and 2-inch for telecom, fire rated for 2-hours. Rubber gasket protects interior from water and debris. 2-gang. Provide with one (1) or two (2) duplex receptacle(s). Rectangular activation, flanged with Decora style flip cover. Finish: aluminum. Legrand/Wiremold 8801S-FC series or approved.
2.4 PULL AND JUNCTION BOXES
   A. Construction: Provide ANSI 49 gray enamel painted sheet steel junction and pull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

   B. Location:
      1. Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
      2. Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.

   C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
      1. Construction: Galvanized cast iron.
      2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
      3. Cover Legend: ELECTRIC.

   D. Fiberglass Handholes: Die molded glass fiber hand holes:
      1. Cable Entrance: Pre-cut 6- x 6-inch cable entrance at center bottom of each side.
      2. Cover: Fiberglass weatherproof cover with nonskid finish.
      3. Cover Legend: ELECTRIC.

2.5 BOX EXTENSION ADAPTER
   A. Construction: Diecast aluminum.

   B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.6 WEATHERPROOF OUTLET BOXES
   A. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap suitably configured for each application, including faceplate, gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS
   A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.

   B. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1, Standard Practice of Good Workmanship in Electrical Construction.
C. Secure boxes rigidly to substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

D. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NEC. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

E. Set wall mounted boxes at elevations to accommodate mounting heights shown on Architectural Elevations.

F. Electrical boxes are shown on drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10-feet if required to accommodate intended purpose.

G. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

H. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.

K. Box Color Coding and Marking: Reference Section 26 05 53, Identification for Electrical Systems.

L. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.

M. Install knockout closures in unused box openings.

N. Clean interior of boxes to remove dust, debris, and other material.

O. Clean exposed surfaces and restore finish.

3.2 OUTLET BOXES INSTALLATION

A. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, following distances above finished floor:
   1. Control Switches:
      a. 48-inches to the top of outlet box.
      b. 4-inches above top of backsplash at countertops/workstations, not-to-exceed 44-inches above finished floor to the top of outlet box per ADA requirements.
   2. Receptacles: 15-inches to the bottom of outlet box.
   3. Telecom Outlets: 15-inches to the bottom of outlet box. Coordinate with Division 27, Communications.
   4. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.
B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.

C. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.

D. Coordinate electrical device locations and elevations (switches and receptacles) with architectural drawings to prevent mounting devices in mirrors, back splashes, and behind cabinets.

E. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Adjacent boxes not aligned vertically to be adjusted at no additional cost to Owner.

G. Use flush mounting outlet box in finished areas.

H. Do not install flush mounting box back-to-back in walls; provide minimum 6-inches separation. Provide minimum 24-inches in acoustic rated walls.

I. In acoustical walls, apply acoustic putty pad on outlet box prior to installation of acoustical blanket.

J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

K. Use stamped steel bridges to fasten flush mounting outlet box between studs.

L. Use adjustable steel channel fasteners for hung ceiling outlet box.

M. Use gang box where more than one device is mounted together. Do not use sectional box.

N. Use gang box with plaster ring for single device outlets.

O. Adjust flush-mounting outlets to make front flush with finished wall material.

3.3 FLOOR BOXES INSTALLATION

A. Use cast floor boxes for installations in slab on grade.

B. Use steel boxes matching fire-rating of floor slab for slab above grade.

C. Set floor boxes level.

D. Adjust floor boxes flush with finish flooring material.

E. Provide sufficient concrete cover around floor box to maintain fire rating of floor slab for slab above grade, and meet manufacturer installation directions for floor box on grade.

3.4 PULL AND JUNCTION BOXES INSTALLATION

A. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.

C. Do not fasten boxes to ceiling support wires.

D. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.5 BOX EXTENSION ADAPTER INSTALLATION

A. Match material to box.

B. Install gaskets at exterior and wet locations.

3.6 WEATHERPROOF OUTLET BOXES INSTALLATION

A. Use cast outlet box in exterior locations exposed to weather and wet locations.

B. Install gaskets.

END OF SECTION
SECTION 26 05 43

ELECTRICAL VAULTS AND UNDERGROUND RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Handholes
   2. Raceways

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

B. In addition, reference the following:
   1. Section 26 05 33, Raceways

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit (EPC-40 and EPC-80).
   2. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   5. NEMA TC 14 - Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
   6. UL 1684 - Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Installer will have documented experience in the placement of vaults for a minimum of 3 years.
   2. Manufacturer will have documented experience in the manufacturer of vaults for minimum of three years.
1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Handholes:
   1. Oldcastle Precast
   2. Jensen Precast
   3. Hubbell/Quazite
   4. Or equal.

B. Raceways:
   1. See Section 26 05 33, Raceways.
   2. Fiberglass (RTRC):
      a. FRE Composites Corp.
      b. Champion Fiberglass
      c. United Fiberglass of America

2.2 HANDHOLES

A. Housing: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors.

B. Extension Rings: Capable of accepting up to 18-inches of extension rings to adapt to re-leveling of grade during construction.

C. Lid: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors, with nonskid finish, neoprene gaskets and stainless steel screws. Same size as opening of housing for as much hand space as possible for wire access.

D. Lid Legend: ELECTRICAL.

E. Cable Entrance: Pre-cut 6 x 6-inch cable entrance at center bottom of each side.

2.3 RACEWAYS

A. See Section 26 05 33, Raceways.

B. PVC Conduit: NEMA TC 2; Schedule 40. Fittings and Conduit Bodies: NEMA TC 3.

C. Plastic Utilities Duct: NEMA TC 6/8; PVC Type DB.


E. Fiberglass Conduit (RTRC), Elbows and Fittings: NEMA TC 14 and UL 1684.
   1. Conduit and Fittings: 0.095 inches wall thickness.
2. Large Sweep Elbows: 1.110 inches wall thickness.
3. Joining Method: Supply each length of conduit with a tapered spigot and an integral bell with an integral urethane Tri-Seal gasket held in place with a retaining ring. Minimum 400 pound for the Tri-Seal joint.
4. Adapters: Provide appropriate UL Listed adapters for transitions to and from PVC and steel conduit.
5. Provide conduit in 20 foot lengths, free of burrs and ridges.
6. Fabricate sweeps in one piece, without couplings, joints or tangent lengths, other than at ends.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's instructions and recommendations.
B. Plan locations of duct runs in advance of the installation. Coordinate with site utility systems and building foundation depths.
C. Duct bank routing is shown on drawings in approximate locations unless dimensions are indicated. Verify routing and termination locations of duct bank prior to excavation for rough-in. Route as required to complete duct system.

3.2 HANDHOLES

A. Excavate to required depth and remove materials that are unstable or unsuitable for good foundation. Prepare level, compacted foundation extending 6-inches beyond base. Some vaults may be piling supported. Check structural drawings and details.
B. Set base plumb and level.
C. Provide minimum 12-inches of pea gravel below handhole for stability and drainage.
D. Turn conduits up into handhold with required bend radius per guidance in 26 05 33, Raceways.

3.3 RACEWAYS

A. Power and System Duct Bank Raceways: PVC, Fiberglass (RTRC) or PVC coated Rigid Metal Conduit.
B. Elbows for Power and System Raceways: Fiberglass (RTRC) elbows or PVC coated Rigid Metal Conduit elbows.
C. Provide all excavation and backfill required. Coordinate trench specs for concrete, soil or sand backfill.
D. Excavate trenches six inches deeper and wider than ductbank burial and cross-sectional requirements. Remove from the site all excavated materials not suitable or specified for backfill.

E. Backfill trenches with sand, tamped firm and even to trench depth level.

F. Backfill with non-expansive soil with limited porosity. Deposit all backfill soil in 6-inch layers. Thoroughly and carefully tamp all backfill soils to 90-95 percent compaction until the ductbank is covered by no less than 12 inches of material. Backfill and tamp the remainder of the excavation at 12-inch intervals. Uniformly grade the finished surface.

G. Provide sheeting, shoring, dewatering and cleaning required to keep the trenches and their grades in proper condition for the work to be carried on.

H. Restore all landscape and paving to like new to match existing.

I. Slope raceways away from buildings and drain towards manholes or vaults with a minimum slope of 3 percent. Drain raceways into manholes or vaults, not into building structures or panels. Where sloping cannot be fully provided and there is a section of raceway where water would flow to a panel, switchboard, transformer, or building, provide a means to discharge the excess water from the raceway, or raceway system, consisting of a box or fitting at a low point prior to equipment entry, or at building entry, with a fitting or plug that can be removed to allow drainage.

J. Cut raceway square using saw or pipe cutter; de-burr cut ends.

K. Insert raceway to shoulder of fittings; fasten securely.

L. Join PVC raceway using adhesive as recommended by manufacturer.

M. Wipe PVC raceway dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

N. Number of equivalent 90-degree bends permitted between pull points: Maximum of three bends for power system conduit banks.

O. Provide suitable fittings to accommodate expansion and deflection where required.

P. Terminate raceway at manhole entries using end bells.

Q. Use suitable separators and chairs installed not greater than 5 feet on centers.

R. Provide 1/4-inch polypropylene pull rope in each empty raceway except sleeves and nipples.

S. Swab raceway. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

T. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.
U. Concrete Encased Raceways:

1. Encasement Concrete: Minimum 2,500 psi mix. Red color additive: Provide concrete mixture ration containing five pounds of red oxide for one yard of concrete.
2. Securely anchor raceway to prevent movement during concrete placement.
3. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.
4. Stagger raceway joints vertically six inches minimum.
5. Connect to existing concrete encasement using dowels.

END OF SECTION
SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Equipment Nameplates
   2. Device Labels
   3. Wire Markers
   4. Underground Warning Tape

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
   2. Manufacturer's standard products of categories and types required for each application as referenced in other Division 26, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.
   3. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equipment Nameplates:
1. B & I Nameplates
2. Intellicum
3. JBR Associates
4. Or equal.

B. Device Labels:
1. Kroy
2. Brady
3. Or equal.

C. Wire Markers:
1. Brady
2. Panduit
3. Sumitomo
4. Or equal.

D. Underground Warning Tape:
1. Allen Systems
2. Brady
3. Or equal.

2.2 EQUIPMENT NAMEPLATES

A. Engraved phenolic plastic, laminate, minimum 1/8-inch thick in the size indicated, with beveled edge border matching letter color. Federal specification L-P-387. All upper case letters in engraver standard letter style of the size and wording indicated. Punched for mechanical fastening, except where adhesive mounting is necessary due to substrate. Embossed tape style labels are not acceptable.

B. Color:
1. Normal (Utility): White letters on black background.
2. Emergency Systems: Black letters on orange background.

C. Letter Size:
1. Use 1/2-inch letters minimum for identifying major equipment and loads, including switchgear, switchboards, etc.
2. Use 1/4-inch or 1/2-inch letters minimum for identifying panels, breakers, etc.
3. Use 3/16-inch minimum for identifying source, voltage, current, phase, and wire configurations.

D. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

E. The Architect, Engineer, Commissioning Agent and Owner reserve the right to make modifications to the nameplates as necessary.

F. Locations:
1. Distribution panels, and branch panels.
2. Main breakers and distribution breakers in distribution panels.
3. Equipment including, but not limited to, motor controllers, disconnects, and VFDs.
4. Low-voltage equipment enclosures including, but not limited to, fire alarm panels, access control panels, and lighting control panels.

2.3 DEVICE LABELS

A. Extra strength, laminated adhesive tape, with 3/16-inch black letters on clear background. Use only for identification of individual wall switches and receptacles. Indicate device name, source panel, and source circuits. Panel and circuit designation written in permanent marker on the back of the plate and inside the back-box. Do not provide punch tape style labels.

B. Label all junction boxes to show system identification, source circuit, or raceway origin. In finished areas, utilize device label. In unfinished areas or above ceilings, use of permanent ink marker is acceptable.

2.4 WIRE MARKERS

A. Description: Vinyl-cloth self-adhesive type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and each load connection.

C. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings and source panel.

D. Control Circuits: control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

2.5 UNDERGROUND WARNING TAPE

A. Description: 6-inch wide inert polyethylene plastic tape, 4-mil thick, detectable type, colored per APWA recommendations unless otherwise noted with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate designations used on Drawings with equipment nameplates and device labels.

B. Install nameplates and labels parallel to equipment lines.

C. Identify empty conduit and boxes with intended use.

D. Provide typewritten branch panel schedules with protective clear transparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designations shown on drawings.

E. Where changes are made in existing panels, distribution boards, etc., provide new labeling and typewritten schedules to accurately reflect the changes.

F. Provide color coded boxes as follows:
3.2 EQUIPMENT NAMEPLATES

A. Degrease and clean surfaces to receive nameplates.

B. Secure equipment nameplates to equipment front using self-tapping stainless steel screws.

C. Secure equipment nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Verify emergency system distribution equipment nameplate colors with Architect/Owner.

E. Panels to include name source, voltage, current phase, wire configuration and fault current rating. Transformers to include source KVA, and secondary voltage, phase, and wire configuration.

F. Provide nameplates for flush mounted branch panelboards identifying name on front door. On inside of door provide nameplate as noted above. Verify with Architect/Owner if nameplate on outside of door is required.

G. Provide a second label at branch panelboards listing the means of identification of branch circuit conductors. This identification legend to consist of the color code used for each voltage system (208Y/120V and 480Y/277V). See Specification Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables, for required conductor color code for this project. Include identification of both voltage systems on each label, regardless of the voltage of the panelboard to which the label is affixed. Comply with requirements of NEC 210.5.

3.3 DEVICE LABELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Degrease and clean surfaces to receive labels.

3.4 WIRE MARKERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide wire markers on each conductor for power, control, signalling and communications circuits.

D. Where switches control remote lighting or power outlets, or where switches or outlets in same location serve different purposes, such as light, power, intercom, etc. or different areas, such as corridor and outside, provide plates with 1/8-inch black letters indicating function of each switch or outlet. Also label the function of light switches where two or more are mounted in same locations.
3.5 **UNDERGROUND WARNING TAPE**

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Identify underground raceways using underground warning tape. Install one continuous tape per underground raceway at 6- to 8-inches below finish grade. Where multiple underground raceways are buried in a common trench and exceeds 16-inch width, install multiple warning tapes not over 10-inches apart (edge to edge) over the entire group of underground raceways.

END OF SECTION
SECTION 26 05 73
ELECTRICAL DISTRIBUTION SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Protective Devices
   2. Protective Device Study
   3. Arc Flash Labels
   4. Arc Flash Risk Assessment

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. IEEE 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
   2. IEEE 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition provide:
   1. Power system studies required under this Section with submittals for electrical equipment, including overcurrent protective devices.
   2. Electrical equipment ordered prior to submittal of power system studies are not compliant with these specifications, and are subject to removal and replacement at no cost to Owner where not in compliance with Code and Contract Documents for selective coordination.
      a. Provide written verification with Stamp or Seal and signature of preparing Engineer.
   3. Provide samples of NFPA 70E compliant arc flash hazard labeling for electrical equipment.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
B. In addition, meet the following:
   1. Study Preparer Qualifications: Qualified engineer of switchgear manufacturer or approved professional engineer.
      a. Experienced in preparation of studies of similar type and magnitude.
      b. Familiar with software analysis products specified.
      a. Acceptable Software Products:
         1) EasyPower
         2) EDSA Micro Corporation.
         3) Operation Technology, Inc; ETAP.
         4) SKM Systems Analysis, Inc; Power Tools for Windows.
   3. Contractor Responsibility: Provide project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, actual circuit lengths and available fault currents from utility. Provide information in a timely matter to allow studies to be completed prior to release of equipment.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 GENERAL

A. Analyze specific electrical and utilization equipment (according to NEC definition), actual protective devices to be used, and actual feeder lengths to be installed.
   1. Scope of Studies: New and existing distribution wiring and equipment, from primary source to buses and branch circuit panelboards.
   2. Primary Source, for Purposes of Studies: Utility company primary protective devices.
   4. Report: State methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with electrical equipment and wiring to be protected by protective devices; identify nodes on diagrams for reference on report that includes:
   1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at main switchboard bus and downstream devices containing protective devices.
   2. Breaker and fuse ratings.
   3. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
   4. Identification of each bus, with voltage.
   5. Conduit materials, feeder sizes, actual lengths, and X/R ratios.
2.2 PROTECTIVE DEVICES

A. Provide protective devices of ratings and settings as required so that protective device closest to fault will open first.

B. Replace existing protective devices to achieve specified performance.

C. Analyze and determine ratings and settings of protective devices to minimize damage caused by fault and so that protective device closest to fault will open first.
   1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
   3. Identify any equipment that is underrated as specified.
   4. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Owner and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in same frame, time curve characteristics of induction relays, CT ranges, etc.
   5. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve change to contract sum.
   6. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
   7. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Engineer.

D. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis; include:
   1. Device identification.
   2. Relay CT ratios, tap, time dial, and instantaneous pickup.
   3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
   4. Fuse rating and type.
   5. Ground fault pickup and time delay.
   6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.
   7. Highlight devices that as furnished by Contractor will not achieve required protection.

E. Specified equipment has been designed and selected to achieve specified performance; ensure that equipment actually installed provides that performance.

F. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of system studies.
2.3 PROTECTIVE DEVICE STUDY

A. Analyze and determine ratings and settings of protective devices to minimize damage caused by fault and so that protective device closest to fault will open first.
   1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
   3. Identify any equipment that is underrated as specified.
   4. Identify existing protective devices that will not achieve required coordination and cannot be field adjusted to do so.
   5. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Owner and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in same frame, time curve characteristics of induction relays, CT ranges, etc.
   6. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve change to contract sum.
   7. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
   8. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Architect.

B. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis; include:
   1. Device identification.
   2. Relay CT ratios, tap, time dial, and instantaneous pickup.
   3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
   4. Fuse rating and type.
   5. Ground fault pickup and time delay.
   6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.
   7. Highlight devices that as furnished by Contractor will not achieve required protection.

2.4 ARC FLASH LABELS

A. Provide label compliant with NFPA 70E guidelines indicating personal protective equipment (PPE) recommended for servicing of electrical equipment while energized, as well as calculated incident energy levels and arc flash protective boundary distance.

2.5 ARC FLASH RISK ASSESSMENT

A. Calculate arc flash incident energy (AFIE) levels and flash protection boundary distances to determine required level of personal protective equipment (PPE) at each bus and piece of
equipment during normal conditions, emergency power conditions, and other operations that
could result in maximum arc flash incident energy levels.
1. Show flash protection boundary distance.
2. Include incident energy levels.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Provide services of qualified field engineer and necessary tools and equipment to test,
calibrate, and adjust installed protective devices to conform to requirements determined by
coordination analysis.

B. Adjust installed protective devices having adjustable settings to conform to requirements
determined by coordination analysis.

C. Submit report showing final adjusted settings of protective devices.

3.2 ELECTRICAL POWER SYSTEM STUDIES

A. Protective Device Study:
   1. Perform time-current coordination analysis with aid of computer software intended for
      this purpose. Include determination of settings, ratings, or types for overcurrent
      protective devices supplied.
   2. Where necessary, make an appropriate compromise between system protection and
      service continuity with service continuity considered more important than system
      protection.
   3. Provide sufficient number of computer generated log-log plots to indicate degree of
      system protection and coordination by displaying time-current characteristics of series
      connected overcurrent devices and other pertinent system parameters.
   4. Computer printouts accompany log-log plots and will contain descriptions for each of
      devices shown, settings of adjustable devices, short-circuit current availability at device
      location when known, and device identification numbers to aid in locating devices on
      log-log plots and system one-line diagram.
   5. Study includes separate, tabular computer printout containing suggested device settings
      of adjustable overcurrent protective devices, equipment where device is located, and
      device number corresponding to device on system one-line diagram.
   6. Provide computer generated system one-line diagram which clearly identifies individual
      equipment buses, bus numbers, device identification numbers and maximum available
      short-circuit current at each bus when known.
   7. Discussion Section which evaluates degree of system protection and service continuity
      with overcurrent devices, along with recommendations as required for addressing system
      protection or device coordination deficiencies.
   8. Call significant deficiencies in protection and/or coordination to attention of Engineer
      and recommendations made for improvements as soon as they are identified.
   9. Contractor responsible for supplying pertinent electrical system conductor, circuit
      breaker, generator, and other component and system information in timely manner to
      allow time-current analysis to be completed prior to final installation.

B. Arc Flash Risk Assessment:
1. Perform arc flash risk assessment with aid of computer software intended for this purpose.
2. Perform arc flash risk assessment in conjunction with short-circuit analysis and time-current coordination analysis.
3. Submit results of assessment in tabular form, and include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
4. Perform analysis under worst-case arc flash conditions, and final report describes, when applicable, how these conditions differ from worst-case bolted fault conditions.
5. Arc flash risk assessment includes recommendations for reducing AFIE levels and enhancing worker safety.
6. Proposed vendor demonstrates experience with arc flash risk assessment by submitting names of at least ten actual arc flash risk assessments it has performed in past year.
7. Proposed vendor demonstrates capabilities in providing equipment, services, and training to reduce arc flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
8. Proposed vendor demonstrates experience in providing equipment labels in compliance with NEC and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

END OF SECTION
SECTION 26 08 10
BUILDING LIGHTING ACCEPTANCE TESTING AND DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Duties of the Team
   2. Time Schedule
   3. Acceptance Testing - Phase I - Documentation
   4. Acceptance Testing - Phase II - Documentation
   5. Acceptance Testing - Phase III - Documentation
   6. This Section describes the acceptance testing and documentation of the lighting system(s) and outlines the duties and responsibilities of the contracting team for acceptance testing.
   7. Supply the acceptance requirements to products, equipment and systems provided under this Division, where indicated on Drawings, and where required by California Title 24 requirements.
   8. Engage the services of a firm specializing in commissioning of lighting systems or submit contractor qualifications for review by architect where testing and documentation is to be performed by contractor.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 COMMISSIONING TEAM

A. Form the Commissioning Team of:
   1. Electrical Contractor's Representative
   2. Lighting Controls Manufacturer's Representative
   3. Inspector of Record
   4. Owner's Staff Representative
PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 DUTIES OF THE TEAM

A. The duties of the Team are as outlined in the Title 24 Requirements and summarized below:
   1. Plan, organize and implement the acceptance testing process and within 1 month of the award of the contract, submit the names and addresses of the Testing team member(s).
   2. The acceptance testing team to submit a complete description of the testing procedures and systems to be tested to the architect for review.
   3. The acceptance testing team to coordinate tests of systems and equipment and assemble documentation related to tests. Submit documentation relative to tests and proposed procedures to design engineer for review prior to submitting documentation to Authority Having Jurisdiction (AHJ). Team responsible for performing data analysis, calculation of performance indices and cross-checking of results with the requirements of Title 24 and the Contract documents. The installing contractor or agent responsible for testing and documentation to record their State of California Contractor's license number or their State of California Professional Registration License number on each Certificate of Acceptance for submittal.
   4. Responsible for submitting Certificate of Acceptance including paper and electronic copies of measurements and monitoring results and supporting documentation to the AHJ. Where AHJ questions results or requires additional testing, complete additional testing and provide required documentation at no additional cost to the Owner.

3.2 TIME SCHEDULE

A. Determine the time period of the commissioning of the systems by the general contractor and acceptance testing team. It is important to note that AHJ will not release a final Certificate of Occupancy until a Certificate of Acceptance is submitted that demonstrates that the specified systems and equipment have been shown to be performing in accordance with the California Title 24 standards.

3.3 ACCEPTANCE TESTING - PHASE I - DOCUMENTATION

A. Team to assemble documentation showing lighting fixture locations, lighting control device locations, control sequences and notes.

B. Per California Title 24 requirements, team to provide record drawings to building Owner within 90 days of receiving a final occupancy permit (reference other specification Sections for requirements on record drawings.)

C. Per California Title 24 requirements, team to provide operating and maintenance manuals to the building Owner (reference other specification Sections for requirements on operation and maintenance manuals.)
3.4 ACCEPTANCE TESTING - PHASE II - INSPECTION AND TESTING

A. Team to review the installation, perform acceptance testing and document results for the following systems:
   1. Occupancy Sensors
   2. Manual Daylight Controls
   3. Automatic Daylight Controls
   4. Automatic Time Switch Controls

B. Review of installation to confirm lighting fixtures and lighting controls are properly located, identified, calibrated, and set points and schedules programmed per contract document requirements.

3.5 ACCEPTANCE TESTING - PHASE III - CERTIFICATION

A. Team to document operating and maintenance information, complete installation certificate, and indicate test results on the Certificate of Acceptance, and submit the Certificate to the AHJ prior to receiving final occupancy permit.

B. Team to submit forms LTG-1-A through LTG-3-A as required by California Title 24 requirements.

3.6 ACCEPTANCE TESTS AND DOCUMENTATION

A. Reference State of California requirements for specific testing procedures and documentation requirements. Contractor is responsible for reviewing and complying with standards as required by Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements Basic Electrical Requirements as well as State and governmental standards related to this work.

B. Reference California Title 24, 2016 Nonresidential Compliance Manual and Documents for specific testing procedures and documentation requirements. Contractor is responsible for reviewing and complying with these standards. The detailed requirements can be found at: http://www.energy.ca.gov/title24/2016standards/index.html.

END OF SECTION
SECTION 26 09 00

CONTACTORS AND CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Electronic Time Switches
   2. Photoelectric Switches
   3. Emergency Lighting Relays

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Shop Drawings: Submit to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, dimensions, support points.
   2. Product Data: Provide for each component showing electrical characteristics and connection requirements.
   3. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as outlined in Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Electronic Time Switches:
   1. Intermatic
   2. Paragon
   3. Sangamo
   4. Tork
   5. Or equal.

B. Photoelectric Switches:
   1. Precision
   2. Paragon
   3. Tork
   4. Or equal.

C. Emergency Lighting Relay:
   1. Nine 24
   2. Bodine
   3. Wattstopper
   4. Or equal.

2.2 ELECTRONIC TIME SWITCHES

A. Double pole, single throw; one N.O. contact, one N.C. contact. 24 hour digital. Battery power source to provide minimum of 3 years of memory back-up. Eight event setpoints. Provide enclosure with separate hinged door, recessed or surface as indicated on Drawings.

2.3 PHOTOELECTRIC SWITCHES

A. Characteristics:
   1. Hermetically sealed light sensitive element installed in die cast weatherproof enclosure.
   2. Adjustable external light level slide.
   3. Swivel adjustable enclosure.

B. Electrical Rating: 120VAC, 1800VA, connected for pilot duty unless otherwise indicated.

2.4 EMERGENCY LIGHTING RELAY

A. UL924 listed for connected load of 20 amps at 277 volt or 120 volt.

B. UL rated N.C. contacts, minimum 20 amps rating.

C. Integral surge protection.

D. Two separate status emergency lighting indicators for troubleshooting:
   1. Amber LED indicates presence of normal utility power.
   2. Red LED indicates presence of unswitched emergency power.
E. Manual and/or automatic diagnostic testing feature.

F. Dimming control: Where 0-10 volt dimming control is connected to emergency lighting, supply and connect auxiliary relay to open dimming 0-10 volt control circuit upon loss of normal power, or else supply emergency lighting relay with integral contact to open 0-10 volt control circuit.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Testing:
   1. Test to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with approved drawings and specifications.
      a. Daylight sensing automatic lighting controls.
      b. Occupant sensing automatic lighting controls.
      c. Automatic time switches for lighting control.
      d. Emergency lighting controls.
   2. Functionally test all control devices to ensure operation in accordance with approved drawings and specifications.
   3. Prepare and complete report of test procedures and results and file with the Owner.

B. Install items per manufacturers written instructions.

3.2 ELECTRONIC TIME SWITCHES

A. Install time switches and other automatic control devices in accessible locations near the source of power or grouped at a common location in mechanical rooms or similar spaces.

3.3 PHOTOELECTRIC SWITCHES

A. Install photoelectric control devices at such locations as necessary to be most effective. Avoid locating photoelectric devices in or at locations where they can be influenced by other than natural light or under eaves. Verify location of equipment with Architect.

B. Exterior Lighting Control: Control exterior lighting and interior atrium lighting using photoelectric switches to energize contactors controlling lighting circuits. Time clocks used to deenergize lighting at any preset time if desired.

3.4 EMERGENCY LIGHTING RELAYS

A. Emergency Relay (UL924):
   1. Provide unswitched emergency circuit, and unswitched and switched normal circuit to UL924 relay for control of emergency luminaires with remaining room luminaires on normal power.
   2. Install each relay within dedicated 4-11/16-inch junction box with double-gang plaster ring for wall or ceiling flush-mount as indicated on Drawings. Where location in ceiling would interfere with removal of ceiling tiles, install relay flush-mounted in nearest wall at ceiling level. Do not locate behind wall switch.
3. Where 0-10 volt dimming control is connected to emergency lighting, supply and connect auxiliary relay to open dimming 0-10 volt control circuit upon loss of normal power.

END OF SECTION
SECTION 26 09 23

OCCUPANCY AND VACANCY SENSORS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Occupancy/Vacancy Sensors (Ceiling and Wall mounted)
   2. Combined Occupancy Sensor/Wall Switches ("Sensor/Switches")
   3. Automatic Switches

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Provide wiring diagrams indicating low voltage and line voltage wiring requirements.
   2. Provide, on reproducible architectural floor plan, a layout of sensors indicating their sensing distribution.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of the Owner, in accordance with California Title 24 requirements.
   2. Prepare and complete report of test procedures and results. Submit these test procedures and results to Owner and Architect.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Occupancy/Vacancy Sensors (Ceiling and Wall mounted):
   1. Passive Infrared Occupancy/Vacancy Sensors:
      a. Acuity nLight
      b. WattStopper
      c. Leviton
      d. Hubbell
      e. Or equal.
   2. Ultrasonic Occupancy/Vacancy Sensors:
      a. Acuity nLight
      b. WattStopper
      c. Leviton
      d. Hubbell
      e. Or equal.
   3. Dual Technology Occupancy/Vacancy Sensors:
      a. Acuity nLight
      b. WattStopper
      c. Leviton
      d. Hubbell
      e. Or equal.

B. Combined Occupancy/Vacancy Sensor:
   1. Acuity nLight
   2. WattStopper
   3. Leviton
   4. Hubbell
   5. Or equal.

C. Automatic Switches:
   1. Acuity nLight
   2. WattStopper
   3. Leviton
   4. Hubbell
   5. Or equal.

D. Basis of Design: Occupancy/Vacancy sensor layout on Drawings are designed based on Acuity nLight Lighting Control product line. Approved manufacturers listed are allowed on condition of meeting the specified conditions including complete sensor coverage of the area controlled and switching of luminaires in the area controlled. Provide additional sensors and power switch packs as needed to provide the same level of functionality as shown on Drawings or required in Specifications. Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.
2.2 GENERAL

A. Occupancy sensor designation indicates sensors automatically turn lights ON when the sensor detects the presence of a person and will automatically turn lights OFF when no presence is detected for a specified amount of time (automatic-on and automatic-off).

B. Vacancy sensor designation requires someone to manually turn the lights ON. The sensor will then automatically turn the lights OFF when no presence is detected for a specified amount of time (manual-on and automatic-off). These sensors must meet California Title 24 requirements.

C. Provide occupancy sensors to sense presence of human activity within desired space and enable or disable on/off manual lighting control function provided by local switches.

D. Upon detection of human activity by detector, sensor initiates time delay to maintain lights on for present period of time. Field adjustable time delay setting from 30 seconds to 15 minutes.

E. Factory set sensors for maximum sensitivity.

F. LED lamp built into sensor indicates when occupant is detected.

G. Provide zero cross relay control with sensors and sensor/switched; relay contacts close and open with AC voltage signal is at zero.

H. Where line voltage sensors and sensor/switches are used, provide to match voltage of controlled circuit.

I. Line Voltage Sensors, Control Units, and Relays: UL listed.

2.3 OCCUPANCY/VACANCY SENSORS (CEILING AND WALL MOUNTED)

A. Passive Infrared Sensors:
   1. Sensor Function: Detects human presence in floor area being controlled by detecting changes in Infrared energy. Sensor detects small movements, i.e., when people are writing while seated at a desk.
   2. Provide temperature compensated dual element pyro-electric sensor and with multi element Fresnel lens.
   4. Provide daylight filter to ensure that sensor is insensitive to short-wavelength infrared waves, i.e., those emitted by sun.
   5. Adjustments and mounting hardware under removable cover to prevent tampering with adjustments and hardware.
   6. Sensor utilizes advanced digital signal processing technology to reduce false offs without reducing sensitivity.
   7. Ceiling-Mounted Sensor:
      a. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
      b. 360 degree sensor range; coverage: 1200 SF, unless otherwise noted on drawings.
c. Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel to allow coverage of large areas.

d. Basis of Design: Acuity nLight Controls.

8. Wall-Mounted Sensor:
a. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
b. 90 degree sensor range with dense wide angle lens; coverage: 1000 SF for desktop motion, unless otherwise noted on Drawings.
c. Swivel mounting bracket for corner mounting to wall or ceiling.
d. Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel to allow coverage of large areas.
e. Basis of Design: Acuity nLight Controls.

B. Ultrasonic Occupancy/Vacancy Sensors:

1. Sensor Function: Detects human presence in controlled floor area by detecting Doppler shifts in 40kHz ultrasound created by sensor.
2. Sensors are precision crystal controlled and do not interfere with each other when two or more are placed in the same area. Sensor includes advanced digital signal processing to reduce false on signals without decreasing sensitivity, as well as immunity to RFI/EMI sources.
4. Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel to allow coverage of large areas.
5. Provide adjustments and mounting hardware under removable cover to prevent tampering.
6. Ceiling-Mounted Sensor:
a. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
b. Maximum protrusion of 1.1-inches and blend in aesthetically with ceiling.
c. Coverage: 360 degree sensor range; coverage: 2,000 SF, unless otherwise noted on Drawings.
d. Basis of Design: Acuity nLight Controls.

7. Ceiling Mounted Sensor - Hallway Sensor Coverage:
a. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
b. Maximum protrusion of 1.5-inches and blend in aesthetically with ceiling.
c. Coverage: 90 linear feet.
d. Basis of Design: Acuity nLight Controls.

C. Dual Technology Sensors:

1. Sensor Function: Combined capability of passive infrared with ultrasonic or microphonic technology as described above.
2. Function: Upon a person entering a space, motion must be sensed by both technologies before lighting will be turned on. After this has occurred, detection by either technology will hold lighting on. Sensors retrigger time delay where only one motion is necessary to turn on lights within 5 seconds after turning off.
3. Wall-Mounted Sensor:
a. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).

b. 90 degree sensor range with dense wide angle lens, coverage; 1000 SF for desktop motion, unless noted on drawings.

c. Swivel mounting bracket for corner mounting to wall or ceiling.

d. Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel allowing coverage of large areas.

e. Basis of Design: Acuity nLight Controls.

4. Ceiling Mounted Sensor:

a. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).

b. 360 degree sensor range; coverage: 1000 SF for half-step motion, unless otherwise noted on Drawings.

c. Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel allowing coverage of large areas.

d. Basis of Design: Acuity nLight Controls.

2.4 COMBINED OCCUPANCY/VACANCY SENSOR/WALL SWITCHES ("SENSOR/SWITCHES")

A. Completely self-contained sensor system that fits into standard single gang box. Internal transformer power supply, latching dry contact relay switching mechanism compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices are not allowed.

B. Passive infrared sensor technology includes advanced signal processing to reduce false triggers without increasing sensitivity. LED indicator blinks when occupant sensed.

C. Rated to switch loads: 800 watts incandescent or 120-volt ballast; 1000 watts 277 volt ballast. Zero-crossing technology switches lighting off when AC voltage is at zero, minimizes contact wear.

D. Provide adjustable daylight feature that holds lighting "off" when desired footcandle level is present.

E. Provide integral off override switch with no leakage current to load or ground.

F. Vandal-resistant lens.

G. Includes neutral wire to meet NEC Code.

H. Finish: White.

I. Alerts for impending shut-off: light flash, audible, both or none.

J. Standard Sensor/Switch:
   1. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off). Factory set to manual on/auto off.
   2. 180 degree sensor range; coverage: 150 SF for desktop activity.
K. Dual Relay Sensor/Switch:
   1. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a
      vacancy sensor (manual-on and automatic-off).
   2. Dual auto-off buttons on face of switch allow end-user to turn off two switch legs in
      room space. Built-in light adjustable level sensor only turns off second of two relays
      when desired footcandle level is present. Otherwise similar to specifications above for
      single-zone sensor/switch.
   3. Defaults to Manual-ON to 50% operation for maximum energy savings.
   4. 180 degree sensor range; coverage: 150 SF for desktop activity.

L. Passive Infrared Wall Switch Vacancy-Only Sensors:
   1. Operates only as a vacancy sensor (manual-on and automatic-off) in accordance with
      California Title 24 requirements.
   2. Adjustable sensitivity (high, low presets).

M. Dual Technology Wall Switch Vacancy-Only Sensors:
   1. Operates only as a vacancy sensor (manual-on and automatic-off) in accordance with
      California Title 24 requirements.
   2. Adjustable sensitivity (high, medium, low, and off presets) individually for passive
      infrared and ultrasonic sensing.

N. Passive Infrared Wall Dimmer Vacancy-Only Sensors:
   1. Operates only as a vacancy sensor (manual-on and automatic-off) in accordance with
      California Title 24 requirements.
   2. Basis of Design: Acuity nLight Controls.

O. Passive Infrared 0-10 V Wall Dimmer Vacancy-Only Sensors:
   1. Operates only as a vacancy sensor (manual-on and automatic-off) in accordance with
      California Title 24 requirements.
   2. Basis of Design: Acuity nLight Controls.

2.5 AUTOMATIC SWITCHES

A. Automatic ("Sentry") Switch:
   1. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a
      vacancy sensor (manual-on and automatic-off).
   2. Controls up to 1800 watts at 120-volt, 4100-watts at 277-volt, suitable for ballast and
      motor loads.
   3. Compatible with Decora style faceplate.
   5. Finish: Match wiring devices unless selected otherwise by Architect.
   6. Capable of being connected with other sentry switches to produce 3 and 4 way
      switching.
   7. Based on power interruptions of following durations from an upstream control panel,
      produces following effects:
a. 5 Seconds: Turns lighting off with no delay.
b. 3 Seconds: Turns lighting on with no delay.
c. 1 to 2 Seconds: Delayed off. Blinks lights and provides audible signal to room occupant. If switch push button is not pressed within 5 minutes, lights are turned off.


B. Digital Timer Switch:
   1. Controls up to 1800 watts at 120 volt, 4100 watts at 277 volt, suitable for ballast and motor loads.
   2. Compatible with Decora style faceplate.
   3. Provide low voltage (24VAC/VDC) version where used as input to lighting relay panel; includes single-pole, double-throw isolated relay rated for 1A at 30VDC.
   4. Electroluminescent LCD display shows timer countdown.
   5. Time out setting range from 5 minutes to 12 hours. Lights can be turned off before time-out setting by holding down on/off button.
   6. Timer countdown can be reset to beginning by holding down push button for 2 seconds.
   9. Room lighting flashed and switch beeps 5 minutes and 1 minute prior to switching room lighting off. Either visible or audible features can be disabled.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install occupancy/vacancy sensors as directed by manufacturer's instructions. Complete connections to control circuits, occupancy sensors, power supply pack and low voltage wiring.

B. Provide power packs for sensor to control number of circuits and/or switch legs within its area of coverage.

C. Field adjust each sensor to maximize its coverage of room space.

D. Relocate sensors with ultrasonic technology to avoid being closer to HVAC diffusers and power packs than recommended by manufacturer.

E. Field set time delay for each device as noted below:
   1. Classrooms and Conference Rooms: 30 minutes.
   2. Restrooms: 15 minutes.
   3. Storage Rooms, Janitor's Closets, Unisex Restrooms: 5 minutes.
   4. All Other Spaces: 15 minutes.

F. Coordinate HVAC control requirements with controls contractor prior to installation.

G. Lighting System Testing and Commissioning:
   1. Test lighting controls to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with Drawings and Specifications. Provide functional testing of sequences of operation to ensure operation in accordance
with Drawings and Specifications. Provide complete report of test procedures and results to engineer and insert approved copy into project closeout documents.

2. Testing includes:
   a. Daylight Automatic Controls
   b. Occupant Sensing Automatic Controls
   c. Automatic Time and Override Controls for Interior Lighting

END OF SECTION
SECTION 26 09 24
DAYLIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Continuous Dimming Daylighting Controller
   2. Switched Daylighting Controller
   3. Local Continuous Dimming Photosensor
   4. Local Switched Photosensor

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards per Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Wiring diagrams indicating low voltage and line voltage wiring requirements.
   2. A layout of sensors indicating their sensing distribution on reproducible architectural floor plan.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

B. In addition, provide:
   1. Daylighting controls that carry a factory warranty for a minimum 5-year duration.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Continuous Dimming Daylighting Controller:
   1. Acuity Controls
2. WattStopper
3. Greengate
4. Or approved equivalent.
5. Basis of Design: Daylighting sensor layout on Drawings are designed based on Acuity Controls product line. Approved manufacturers listed below are allowed on condition of meeting specified conditions including complete sensor coverage of area controlled and switching of luminaires in area controlled. Provide additional sensors and power switch packs as needed to provide same level of functionality as shown on Drawings. Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.

B. Switched Daylighting Controller:
1. Acuity Controls
2. WattStopper
3. Greengate
4. Or approved equivalent.
5. Basis of Design: Daylighting sensor layout on Drawings are designed based on Acuity Controls product line. Approved manufacturers listed below are allowed on condition of meeting specified conditions including complete sensor coverage of area controlled and switching of luminaires in area controlled. Provide additional sensors and power switch packs as needed to provide same level of functionality as shown on Drawings. Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.

C. Local Continuous Dimming Photosensor:
1. Acuity Controls
2. WattStopper
3. Greengate
4. Or approved equivalent.
5. Basis of Design: Daylighting sensor layout on Drawings are designed based on Acuity Controls product line. Approved manufacturers listed below are allowed on condition of meeting specified conditions including complete sensor coverage of area controlled and switching of luminaires in area controlled. Provide additional sensors and power switch packs as needed to provide same level of functionality as shown on Drawings. Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.

D. Local Switched Photosensor:
1. Acuity Controls
2. WattStopper
3. Greengate
4. Or approved equivalent.
5. Basis of Design: Daylighting sensor layout on Drawings are designed based on Acuity Controls product line. Approved manufacturers listed below are allowed on condition of meeting specified conditions including complete sensor coverage of area controlled and switching of luminaires in area controlled. Provide additional sensors and power switch packs as needed to provide same level of functionality as shown on Drawings. Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.
2.2 CONTINUOUS DIMMING DAYLIGHT CONTROLLER

A. Control dimming of interior lights in response to light level data, compatible with 0 to 10VDC dimming ballasts. Control system to be open loop, to provide three output control zones consisting of a 0 to 10VDC signals compatible with fluorescent dimmable ballasts. Control system to include three relay outputs capable of switching each of three output zones off after an adjustable time delay when a given channel is fully dimmed.

B. Control module to include following characteristics:
   1. Seven individually adjustable parameters for each channel:
      a. Setpoint: 5 to 60 footcandles;
      b. Minimum Output: 0 to 4 volts DC;
      c. Maximum Output: 6 to 10 volts DC;
      d. Ramp Rate: 5 to 60 seconds;
      e. Fade Rate: 5 to 60 seconds;
      f. Cutoff Time Delay: 0 to 20 minutes or disabled;
      g. Load Shed Limit: 0 to 10 volts DC.
   2. Compatible with 0 to 10VDC dimming ballasts.
   3. Suitable for panel mounting on DIN rail.
   4. When daylighting is adequate for a channel to fully dim; lights switch off after an adjustable time delay via relay pack connected to controller. This feature can also be disabled if lights must remain when fully dimmed.
   5. LCD display with menu-driven, pushbutton programming without special tools or accessories; automatic internal calculation for dimming requirements of individual channels for simplified setup.
   6. Operates from either 120VAC or 277VAC power source.
   7. Automatic Off Control.

C. Utilize low voltage photosensor to continuously measure light levels. Photosensor range is 30 to 6000 footcandles. Adjustments and calibrations capable of being made at control module, not at remote photosensor.

D. Basis of Design: WattStopper LCD-203 series control module with LS-290C photosensor and WattStopper BT-203 power pack. Control module mounted in factory-approved enclosure with factory-installed DIN rails (WattStopper LS-E8, LS-E12, or approved equivalent) and DC power supplies as needed.

2.3 SWITCHED DAYLIGHTING CONTROLLER

A. Switched control of interior lights in response to photocell input. Control system to be open loop, and will provide three output control zones as shown on Drawings.

B. Control module will include following characteristics:
   1. Five individually adjustable parameters for each channel:
      a. Setpoint: 5 to 60 footcandles;
      b. Programmable Deadband: 10 to 80 percent;
      c. On Delay: 5 to 60 seconds;
      d. Off Delay: 3 to 60 minutes;
      e. Load Shed Limit: 5 to 60 footcandles.
2. Compatible with 0 to 10VDC dimming ballasts.
3. Suitable for panel mounting on DIN rail.
4. Lights switched via relay pack connected to controller.
5. LCD display with menu-driven, pushbutton programming without special tools or accessories; automatic internal calculation for dimming requirements of individual channels for simplified setup.
6. Operates from either 120VAC or 277VAC power source.

C. Utilize low voltage photosensor to continuously measure light levels. Photosensor range is 30 to 6000 footcandles. Adjustments and calibrations will be capable of being made at control module, not at remote photosensor.

D. Basis of Design: WattStopper LCO-203 series control module with LS-290C photosensor and WattStopper BT-203 power pack. Mount control module in factory-approved enclosure with factory-installed DIN rails (WattStopper LS-E8, LS-E12, or approved equivalent) and DC power supplies as needed.

2.4 LOCAL CONTINUOUS DIMMING PHOTOSensor

A. Provide low voltage, indoor photocell to interface with electronic dimming ballasts using low voltage (0 to 10VDC) control signal.

B. Spectral filtering system to measure relative levels of daylighting and indoor lighting within control space. Measures light as human eye perceives; linear photocell response with greater than 1 percent accuracy.

C. Ceiling-mounted 2.4-inch diameter, 0.875-inch depth white housing.

D. 10VDC input voltage, 0.2 to 10VDC output voltage. 20 to 60 footcandle adjustable range with plus or minus 3 percent accuracy. One photocell controls up to 50 ballasts. 5 year warranty. White finish.

E. Automatic Off Control.

F. Provide with separate handheld remote controller to field program target lighting levels for daytime and nighttime (i.e. when plenty of daylighting is available and when no daylighting is available).


2.5 LOCAL SWITCHED PHOTOSensor

A. Low voltage, indoor photosensor to switch lighting using power pack; integrate with room occupancy sensors.

1. LCD display under removable cover to display four user-adjustable parameters:
   a. ON Setpoint.
   b. 1-850 footcandles.
   c. OFF Setpoint (25 percent to 100 percent above ON Setpoint).
   d. OFF Setpoint time delay (3 to 30 minutes).

2. Dimensions: 2.4-inches diameter by 0.7-inches deep.
3. White finish; surface mounted. Mountable in top-lit or side-lit position.
4. Voltage: 12/24VDC. LED status indicator.


PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install photocells as directed by manufacturer's instructions. Complete connections to control circuits, photocells, control modules, power supply pack and low voltage wiring.

B. Photocell placement and wiring:
   1. Drawings are schematic, and show photocell quantities together with the daylighting zones that they control.
   2. Reference manufacturer installation instructions for the recommended location and orientation of photocell with respect to exterior glazing and both interior and exterior lighting.
   3. Reposition sensor at no additional cost to Owner to avoid conflict between sensor and object obscuring its view, and between sensor and both interior and exterior lighting that causes daylighting controls to repeatedly increase and decrease in brightness (i.e. "cycling").
   4. Field wire photocell for correct footcandle range (i.e., WattStopper LS-290C photocell has three jumper selectable footcandle ranges: 3 to 300 fc, 30 to 3000 fc, 60 to 6000 fc).

3.2 LIGHTING SYSTEM CALIBRATION, DEMONSTRATION, TRAINING, TESTING AND COMMISSIONING

A. Prior to adjusting and calibrating daylighting control system and local photocell field adjustable settings, contact local manufacturer representative and arrange for representative to visit site to educate both field installer and Owner's Authorized Representative on the operation of the controls.

B. Use manufacturer's published testing and adjusting procedures to adjust sensors and daylight sensitivity to the satisfaction of Owner.

C. Daylight Dimming Zone Calibration:
   1. After all furniture is installed, all daylighting zones are to be field calibrated using a digital photometer. Adjust photocell and control system parameters to maintain an even light level at the work plane.
   2. Single and dual daylighting zones are to be adjusted to maintain an even light level at the work plane throughout connected zones and adjoined areas.

D. Daylight Dimming Zone Lighting Level Setpoints:

<table>
<thead>
<tr>
<th>Area</th>
<th>Setpoint (Average Footcandles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrium</td>
<td>50 FC</td>
</tr>
<tr>
<td>Open Offices</td>
<td>30 FC</td>
</tr>
<tr>
<td>Private Offices</td>
<td>40 FC</td>
</tr>
<tr>
<td>Conference Rooms</td>
<td>30 FC</td>
</tr>
</tbody>
</table>
DAYLIGHTING CONTROLS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridors</td>
<td>5 FC</td>
</tr>
<tr>
<td>Lobby</td>
<td>10 FC</td>
</tr>
<tr>
<td>Classrooms</td>
<td>30 FC</td>
</tr>
<tr>
<td>Gymnasiums</td>
<td>50 FC</td>
</tr>
<tr>
<td>Kitchen</td>
<td>50 FC</td>
</tr>
<tr>
<td>Labs</td>
<td>50 FC</td>
</tr>
<tr>
<td>Library</td>
<td>30 FC</td>
</tr>
<tr>
<td>Museum Display Areas</td>
<td>30 FC</td>
</tr>
<tr>
<td>General Warehouse/Storage</td>
<td>10 FC</td>
</tr>
</tbody>
</table>

E. Prepare and complete report of test procedures and results including the final daylighting level setpoints as set while using a digital photometer. Submit these test procedures and results to Engineer and Commissioning Authority.

F. Test lighting controls to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with Drawings and Specifications. Provide functional testing of sequences of operation to ensure operation in accordance with Drawings and Specifications. Provide complete report of test procedures and results to Engineer and Commissioning Authority and insert approved copy into project closeout documents.

G. Testing Includes:
1. Daylight Automatic Controls
2. Occupant Sensing Automatic Controls
3. Automatic Time and Override Controls for Interior Lighting
4. Automatic Time and Photo Controls for Exterior Lighting

H. Training: Provide minimum 2-hour training session to Owner's Authorized Representatives at a time approved by Owner after Owner has received approved operation and maintenance manuals. Training to include discussion of operation, adjustment, and replacement of sensors, photocells and control.

END OF SECTION
SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Two-Winding Transformers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

B. In addition, reference the following:
   1. Section 26 24 13, Integrated Switchboards.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. UL 1561: Dry-Type General Purpose and Power Transformers.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Manufacturer shall provide copies of following documents to owner for review and evaluation in accordance with Division 01 and Division 26.
      a. Product data on specified product documenting the following:
         1) Dimensions
         2) Weight
         3) KVA
         4) Voltage
         5) % Impedance
         6) Taps
         7) Insulation Class
         8) Sound Level
      b. Wiring Diagram
      c. Installation Instructions

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.
B. In addition, meet the following:
   1. Production test each unit according to NEMA Standard 20.
   2. The manufacturer of the transformer as indicated by the label on the transformer shall be the manufacturer of the major components within the transformer.
   3. The manufacturers listed within this specification have been selected for use on this project. All others need to be pre-approved by the engineer before submitting.
   4. Low voltage dry-type transformers as defined by California Title 24 building efficiency requirements shall be certified by the manufacturer as compliant with the California Energy Commission (CEC) Appliance Efficiency Regulations, Title 20 [20 CCR Section 1605.1.(t)(1)]. This certification must be verifiable from the CEC Modernized Appliance Efficiency Database System (MAEDBS). Any low voltage dry-type transformer that is not listed in the database will not be acceptable for this project.

1.6 WARRANTY
   A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 OPERATION AND MAINTENANCE DATA
   A. Manufacturer shall provide copies of installation, operation and maintenance procedures to owner in accordance with Section 01785, Operation and Maintenance Data, and Division 26.
   B. Submit operation and maintenance data based on factory and field testing, operation and maintenance of specified product.

1.8 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, protect, and handle products in accordance with the manufactures recommendations.
   B. Dry type transformers shall be located in well-ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Indoor locations shall be protected to prevent moisture from entering enclosure.
   C. Equipment shall be shipped with edge and top protection that is adequate to protect the transformer enclosure from common dents and scratches.

1.9 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)
   A. Follow (standards) service conditions before, during and after transformer installation.

1.10 FIELD MEASUREMENTS
   A. Make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ABB/General Electric
B. Eaton
C. Schneider Electric/Square D
D. Basis of Design: ABB/General Electric. Manufacturers listed are allowed on condition of meeting specified conditions including available space for equipment and Code required working clearances. Remove and replace equipment installed that does not meet these conditions at no cost to Owner.

2.2 TWO-WINDING TRANSFORMERS

A. Description: Factory assembled, air cooled dry type transformer. Efficiency compliant with Federal Code 10 CFR Part 431 and DOE 2016 efficiency requirements. NEMA TP-1 efficiency levels are not acceptable.

B. General Requirements:
1. Transformers supplied to this specification shall be able to operate continuously at 100 percent nameplate rating at ambient temperature not exceeding 40 degrees C. Maximum temperature at top of enclosure shall not exceed 50 degree C rise above 40 degree C ambient.
2. Transformer shall have self-cooled sound levels equal to or lower then those established by ANSI/IEEE.

<table>
<thead>
<tr>
<th>KVA</th>
<th>Sound Levels (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9</td>
<td>40</td>
</tr>
<tr>
<td>10-50</td>
<td>45</td>
</tr>
<tr>
<td>51-150</td>
<td>50</td>
</tr>
<tr>
<td>151-300</td>
<td>55</td>
</tr>
<tr>
<td>301-500</td>
<td>60</td>
</tr>
<tr>
<td>Measured per ANSI C89.2-1986</td>
<td></td>
</tr>
</tbody>
</table>

3. Transformer shall be sound tested in the factory prior to shipment. A record of the sound testing shall be retained by the manufacturer.
4. Transformers shall use properly classified UL approved temperature ratings. Temperature rise ratings shall be in accordance with UL 1561. Insulation ratings shall be as indicated in drawings.
5. Transformer shall carry the fully-rated load continuously when the surrounding air does not exceed 30C/86F average, 40C/140F maximum and adjacent structures do not prohibit the free movement of cooling air.
6. Transformers 5 KVA and above shall be able to meet ANSI/IEEE C57.96 daily overload requirements listed in drawings. Transformers loaded in accordance with this paragraph
shall be capable of long service life under thermal conditions specified. There shall be no need for derating.

7. Enclosures shall meet UL 1561 requirements for the following characteristics:
   a. Ventilation Openings;
   b. Corrosion Resistance;
   c. Cable Bending Space;
   d. Surface Temperature Rise;
   e. Wiring Compartment Temperature Rise;
   f. Terminations.

8. Transformer Construction
   a. Transformer core shall be constructed of high grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Magnetic flux densities shall be kept well below core saturation point. Transformer core shall be clamped using insulated bolts through the core laminations to provide consistent pressure throughout the core length. Completed core and coil shall be bolted to enclosure base and isolated from base by rubber vibration-absorbing mounts.
   b. Transformer core shall be visibly grounded to enclosure.
   c. Enclosure shall be constructed of heavy gauge steel.
   d. Coils shall be aluminum.

C. Primary Voltage: 480 volts, 3 phase.

D. Secondary Voltage: 208Y/120 volts, 3 phase.

E. Impedence: 3 to 5 percent, unless otherwise noted on drawings. Minimum reactance 2 percent.

   1. Interior: Type 1.
   2. Ventilated.
   3. Provide lifting eyes or brackets.


2.3 TESTING

A. Transformers furnished to this specification shall receive the following production tests:
   1. Applied Potential;
   2. Induced Potential;
   3. No Load Losses;
   4. Voltage Ratio;
   5. Polarity;
   6. Continuity

B. Manufacturer shall perform the following additional tests on units identical to the design type being supplied to this specification. Manufacturer shall provide on request test data sheets to prove performance of these tests.
   1. Sound Levels
   2. Temperature Rise Tests
   3. Full-Load Losses
4. Regulation
5. Impedance

2.4 FINISH

A. Finish shall consist of degreasing, phosphate cleaning, and an electrodeposit ANSI 61 gray enamel paint.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set transformers plumb and level.
B. Provide seismic restraints.
C. Provide grounding and bonding in accordance with Section 26 05 26, Grounding and Bonding of Electrical Systems.
D. Unacceptable Humming and Noise Levels: Revise installation as required to achieve a noise level less than or equal to those defined in NEMA ST-20 for associated transformer size or replace with a new unit with an acceptable sound level.
E. Provide equipment nameplates per Section 26 05 53, Identification for Electrical Systems.
F. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
G. Install per manufacturer's instructions.
H. Install required safety labels.

3.2 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting.
B. Perform inspections and tests listed in accordance with manufacturers requirements. In addition including following:
   1. Perform turns ratio tests at tap positions.
   2. Verification that as-left tap connections are as specified.
   3. Perform excitation-current tests on each phase.
   4. Measure resistance of each winding at each tap connection.
   5. Overpotential test on high- and low-voltage windings-to-ground.
C. Check for damage and tight connections prior to energizing transformers.

3.3 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION
SECTION 26 24 13
INTEGRATED SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Integrated Switchboards

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

B. In addition, reference the following:
   1. Section 26 05 73, Electrical Distribution System Studies.
   2. Section 26 28 00, Overcurrent Protective Devices.
   3. Section 26 22 00, Low-Voltage Transformers
   4. Section 26 24 16, Panelboards

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and
   Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. UL 891, Standards for Switchboards.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330,
   Submittal Procedures.

B. In addition, provide:
   1. Operation and Maintenance Manuals:
      a. After completion of work and start-up of the equipment at the project site, deliver
         to the Owner's Authorized Representative operation instructions, maintenance
         manuals and drawings presenting full details for care and maintenance of each
         time of equipment provided under this Contract. Number of copies in accordance
         with Section 01785, Operation and Maintenance Data.
      b. Each copy to contain the operating and maintenance information and parts lists for
         equipment provided under this Contract. When necessary, provide supplemental
         drawings to show system operation and servicing maintenance points. For
         electrical components, provide wiring and connection diagrams. Include
         instructions required to accomplish specified operation and functions. Data to be
         neat, clean and legible.
      c. Switchboard drawings and wiring diagrams to be included and up to date at the
         completion of start-up and system acceptance by the Owner. Drawings and wiring
         diagrams to include any field modifications or changes to reflect actual as-installed
         conditions.
d. In general, the manual to include, but not necessarily be limited to, the following:
   1) Switchboard Elevation and One line.
   2) AC and DC Schematic and Physical Component Layout Drawings.
   3) Remote Interface Drawing.
   4) Bill of Material.
   5) Description of Operation.

e. Provide manuals in accordance with Section 01785, Operation and Maintenance Data, adequately labeled with the project name and location and the contents indexed.

2. Record Drawings
   a. Final As Built Drawings. The final (as built) drawings shall include the same drawings as the original construction drawings and shall incorporate all changes made during the manufacturing process.
   b. Installation Instructions.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Integrated Switchboard
   1. Basis of Design: ABB/General Electric
   2. Eaton
   3. Schneider Electric/Square D
   4. Or approved equivalent.

B. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, selective coordination per Section 26 05 73, Electrical Distribution System Studies, and amps interrupting capacity (AIC). Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.
2.2 RATINGS

A. The assembly shall be rated to withstand mechanical forces exerted during short circuit conditions when connected directly to a power source having available fault current as shown on drawings.

B. Short circuit rating shall be the interrupting rating of lowest rated device in the switchboard.

C. Switchboard protective devices shall be furnished as listed on drawings and specified herein, including interconnections, instrumentation and control wiring. Switchboards and devices shall be rated for the voltage and frequency listed on the drawings.

D. Switchboard service entrance sections shall comply with UL service entrance requirements including a UL service entrance label, incoming line isolation barriers, and a removable neutral bond to switchboard ground for solidly grounded wye systems.

2.3 CONSTRUCTION

A. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

B. Switchboards shall be fully self-supporting structures with ninety 90 inch tall vertical sections bolted together to form the required arrangement.

C. Switchboard shall be NEMA 1 dead front construction

D. All sections of the switchboard shall be rear aligned with depth as shown on the drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall.

E. The assembly shall be provided with adequate lifting means.

F. Switchboard to be provided with barriers between each vertical section.

2.4 BUS

A. All bus bars shall be silver plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient. Bus shall be braced for 65,000 AIC.

B. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.

C. A copper ground bus (minimum 1/4 x 2 inch), shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.
D. All hardware used on conductors shall be high tensile strength and zinc plated. All bus joints shall be provided with conical spring type washers. Bellville washers used only on aluminum connections.

2.5 WIRING / TERMINATIONS

A. Small wiring, necessary fuse blocks, and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriated designations on manufacturer’s wiring diagrams.

B. Mechanical type terminals shall be provided for all line and load terminations suitable for copper of aluminum cable rated for 75 degrees C of the size as indicated on the drawings.

C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

E. The switchboard manufacturer shall wire all panelboards from the associated feeder breaker to the panelboard as noted on the drawings. The wiring to be installed in the factory and shall not be installed in the field.

2.6 INTEGRATED PANELBOARDS

A. The switchboard manufacturer as shown on the contract drawings shall integrate and assemble panelboards into the switchboard. The panel shall be recessed in the switchboard enclosure a minimum of four inches from the front of the switchboard to allow easy access to line and/or load conductors entering/exiting bottom. Three quarter inch (3/4) breakers shall not be used in any part of the panelboard.

B. Integrated panelboards shall be General Electric type. Ratings of the panelboards shall meet marked ratings of the switchboard.

C. Integrated panelboards to have standard door configurations.

D. Integrated panelboards shall meet other criteria as shown in Section 26 24 16.

2.7 INTEGRATED DRY TYPE TRANSFORMERS

A. The switchboard manufacturer as shown on the contract drawings shall integrate and assemble dry type distribution transformers into the switchboard. The transformer shall be secured in a manner that assures the structural integrity of the vertical switchboard section and the
transformer. Adequate ventilation for the transformer and other installed components shall be provided within the switchboard.

B. The switchboard manufacturer shall wire the transformer from the feeder overcurrent device to the line side of the transformer in accordance with UL and the National Electric Code utilizing copper conductors. The switchboard manufacturer shall wire the secondary side of the transformer to the load or panelboard shown on the drawings in accordance with UL and the National Electric Code utilizing copper conductors.

C. Switchboard manufacturer to install vibration dampening device between transformer and support to minimize noise.

D. Integrated transformers shall meet other criteria as shown in Section 26 22 00.

2.8 ENCLOSURES

A. Integrated Switchboard shall be NEMA 1 Enclosure

2.9 NAMEPLATES

A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short circuit rating, manufacturer’s name, general order number, and item number. Refer to drawings for actual names and other information.

B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, lighting contactors, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

2.10 FINISH

A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.

2.11 FEEDER CIRCUIT BREAKERS

A. Switchboard to be equipped with breakers as shown on the drawings.

B. Breakers to be rated for 65,000 AIC.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Provide concrete housekeeping pad. Extend 6-inches beyond switchboard width and depth dimensions. Minimum 3-inches above finished floor. Install plumb and level.
B. Verify that field measurements are as indicated on Shop Drawings.

C. Install in a neat and workmanlike manner and in location shown on Drawings, according to NEMA PB 2.1.

D. Adjust all operating mechanisms for free mechanical movement.

E. Tighten bolted bus connections in accordance with manufacturer's instructions.

F. Reference Section 26 08 05, Electrical Acceptance Testing for testing requirements.

3.2 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

B. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory.
   1. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of the equipment.
   2. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities.
   3. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground.

3.3 SWITCHBOARDS INSTALLATION

A. Shop inspect and test switchboard according to NEMA PB 2.

B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.

C. Install switchboard in accordance with manufacturer's installation instructions.

D. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.

F. Provide engraved nameplates per Section 26 05 53, Identification of Electrical Systems.

G. Provide fuses in each switch.

H. Perform field inspection and testing.

I. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

J. Measure, using a Megger, insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 Vdc; minimum acceptable value for insulation resistance is 1 megohms.
K. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturers recommended torque values.

L. Physically test key interlock systems to check for proper functionality.

M. Test ground fault systems by operating push-to-test button.

N. Adjust circuit breaker trip and time delay settings to values indicated.

O. Adjust circuit breaker trip and time delay settings to values as instructed by Engineer.

P. Clean exterior and interior of switchboard in accordance with manufacturers installation instructions.

Q. Vacuum construction dust, dirt, and debris out of switchboard interior.

R. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

END OF SECTION
SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY
A. Work Included:
   1. Panelboards

1.2 RELATED SECTIONS
A. Contents of Division 26, Electrical apply to this Section.
B. In addition, reference the following:
   1. Section 26 24 13, Integrated Switchboards.
   2. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS
A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.
B. In addition, meet the following:
   1. UL 67, Standards for Panelboards.

1.4 SUBMITTALS
A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE
A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY
A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Panelboards:
   1. ABB/General Electric
   2. Eaton
   3. Schneider Electric/Square D
   4. Or equal.
B. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances. Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

C. Basis of Design: ABB/General Electric, Type AE and AQ Panelboards. Manufacturers listed are allowed on condition of meeting specified conditions including available space for the equipment and Code required working clearances. Remove and replace electrical equipment installed that does not meet these conditions at no cost to Owner.

2.2 PANELBOARDS

A. Description: Panelboards 400 amps or less. NEMA PB1, Type 1 as indicated on drawings, circuit breaker type. Maximum enclosure depth: 6-inches for surface mounted, 5 3/4-inches for flush mounted.

B. Maximum Width: 20-inches.

C. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated panelboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate with serving electrical utility.

D. Bus bars
   1. Bus bars shall be phase sequenced, fully insulated and supported by high impact Noryl (or equal) interior base assemblies.
   2. Bus bars shall be fabricated using aluminum.
      a. Aluminum bus bars shall have sufficient cross sectional area to meet UL 67 temperature rise requirements through actual tests.
   3. Bus bars shall be mechanically supported by zinc finished galvanneal steel frames to prevent vibration and damage from short circuits.
   4. Terminations shall be UL tested and listed and suitable for UL copper wire.
   5. Provide 1 continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors for bolt-on branch circuit breakers. Bus bars shall be rated as indicated in drawings.
   6. Split solid neutral bus shall be plated and located in main compartment for all incoming neutral cables to be same length.
   7. Lugs shall be rated for 75 degree C terminations.
   8. Main lugs for copper conductors shall be bolted lugs. Lugs for aluminum conductors shall be compression lugs.
   9. Lug bodies shall bolt in place.

E. Lugs: Mechanical type for conductors.

F. Provide double lugs and/or feed-through lugs for feed through feeders.

G. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for poles; UL listed. Predrill bus for bolt-on breakers.
1. Type SWD for lighting circuits.
2. Type HACR for air conditioning equipment circuits.
3. Class A ground fault interrupter circuit breakers where scheduled.
4. Class B ground fault equipment protection circuit breakers for heat trace and other circuits as required by Code. Provide shunt trip circuit breakers where scheduled; provide wiring to remote trip switch/contacts as indicated on Drawings.
5. Do not use tandem circuit breakers.

H. Accessories: Provide where indicated: Class A ground fault circuit interrupter (GFCI), auxiliary switch and alarm switch.

I. Cabinet Front: Provide flush or surface mounting as shown on the schedules, drawings, or otherwise noted. Cabinet front with concealed hinged front cover door-in-door construction, metal directory frame with heavy clear plastic protector, flush lift latch and lock, two keys per panel all keyed alike.

J. Provide boxes with removable blank end walls and interior mounting studs. Provide interior support bracket for ease of interior installation.

K. Furnish surface mounted cabinet boxes without knockouts.

L. Minimum Integrated Short Circuit Rating:
   1. 10,000 amperes symmetrical for 240 V panelboards.
   2. 14,000 amperes symmetrical for 480 V panelboards.

M. Finish:
   1. Boxes shall be corrosion resistant, zinc finish galvanneal.
   2. Fronts shall be powder finish painted ANSI 61 gray.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install panelboards in accordance with NEMA PB 1.1, NECA 1 and manufacturers installation instructions.

B. Install panelboards level and plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6-feet 6-inches to top of panelboard; install panelboards taller than 6-feet 6-inches with bottom no more than 4-inches (100 mm) above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Include all "spaces" and "spares." Revise directory to reflect circuiting changes and as-installed conditions. Use final Owner designated room names and numbers, and not designations shown on drawings.

F. Provide engraved plastic nameplates per Section 26 05 53, Identification for Electrical Systems.

G. Provide arc flash labels.
H. Provide three (3), 1-inch spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.

I. Provide permanent identification number in or on panelboard dead-front adjacent to each breaker pole position. Horizontal centerline of numbers to correspond with centerline of circuit breaker pole position.

J. Ground and bond panelboard enclosure per NEC.

K. Paint:
   1. Standard factory finish unless noted otherwise.
   2. Panelboards located in finished interior areas in view of building occupants; paint to match adjacent wall surface. Color and paint preparation as specified by Architect. Covers to be painted off wall, then installed over dried, painted wall surface.

L. Provide handle guards on each circuit supplying obviously constant loads such as fire alarm, security, lighting controls, refrigerators and freezers, fire protection, etc.

M. Provide interior wiring diagram, neutral wiring diagram, UL label, and short circuit rating on interior or in booklet format inserted in sleeve inside panel cover.

N. Verify available recessing depth and coordinate wall framing with other divisions.

O. Maintain fire rating of wall where panels are installed flush in fire rated walls.

P. Perform inspections and tests in accordance with manufacturer's requirements.

Q. Thoroughly clean exterior and interior of each panelboard in accordance with manufacturer's installation instructions.

R. Vacuum construction dust, dirt, and debris out of each panelboard.

S. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

3.2 PANELBOARDS INSTALLATION

A. Breakers being added to existing panelboards: Coordinate breaker type and short circuit rating with existing panelboard. Breakers to match existing in manufacturer's type and AIC rating. Provide new typed circuit directory.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION
SECTION 26 27 13

ELECTRICAL METERING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Energy Metering

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Energy Metering
      a. E-Mon D-Mon Class 3000 with ModBus Communications Series.
      b. Or approved equivalent.

2.2 ENERGY METERING

A. Provide fully electronic meter with cycling 8-digit LCD display for energy consumption (kWh), current and peak load (kW). Meter includes rate of consumption indication and segment test button to ensure integrity of display.

B. Energy Consumption: Meter to indicate real time power consumption levels for field-testing and certification. Manually reset to zero.
C. Enclosure: Heavy duty JIC steel enclosure suitable for indoor installation, lockable for preventing unauthorized access.

D. Operating Parameters:
   1. Voltage: Up to 600 volts rms AC available.
   2. Current: Up to 3200 amps rms AC available.
   3. Power Factor: 0.5 lagging to 0.5 leading.
   4. Frequency: 50 to 60 Hz.
   5. Voltage Operating Range: Plus or minus 25 percent of rated voltage.
   6. Temperature Range: Minus 20C to plus 50C.
   7. Humidity: 0 to 95 percent non-condensing.
   8. Voltage Overload: Plus 25 percent continuous, plus 100 percent for 20 cycles.

E. Current and Peak Load: Supply meter with demand (Kw) reading. Demand reading to show highest peak demand and date and time peak occurred.

F. Sampling: 15 or 30 minute demand interval (factory default: 15 minutes).

G. Integral self-contained back-up system to maintain memory and display during power failures.

H. 0-2V voltage output current sensors to allow paralleling and/or mounting up to 2000-feet from meter. Split core type sensor configuration to allow installation without powering down.

I. Standards: UL listed; compliant with ANSI C12.1 and C12.16 specifications with split-core current sensors.

J. Provide meter with following auxiliary device for interfacing to energy management system: ModBus communications.

K. Include a submeter with voltage, current and wire-configuration (2-, 3- or 4-wire, single or three-phase, grounded and undergrounded) as required on drawings.

L. Conductors from current sensors and conductors for monitoring line voltage can be run in same conduit.

PART 3 - EXECUTION

3.1 ENERGY METERING INSTALLATION

A. Submetering Equipment:
   1. Cabling between current and voltage sensors and meter display enclosure.
   2. One-hour video recorded training period for Owner in use of meter.
   3. Blank engraved phenol label with white lettering for each meter, listing load monitored (e.g., "Panel A," "Chiller #3," etc.). Use red label with white lettering where load is on generator backup.
   4. Commons multiple meter unit cabinet with blank spaces where multiple meters are mounted as shown on one-line diagram and/or floor plans (e.g., 8 meter cabinet with 3 blank spaces where 5 meters are shown in common location).
5. ModBus cabling between meters, and from meter to energy management system.

END OF SECTION
SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provision of materials, installation and testing of:
   1. Wall Switches
   2. Receptacles
   3. Finish Plates
   4. Wall Dimmers
   5. Surface Covers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Wall switches and Dimmers
   2. Receptacles
   3. Wall Plates
   4. In-Use Cover

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wall Switches:
   1. Decorative AC Rocker Switch Characteristics:
a. Cooper
b. Hubbell
c. Leviton
d. Legrand P&S
e. Or equal.

B. Receptacles:
   1. Commercial Grade:
      a. 20 Amp:
         1) Cooper 5362
         2) Hubbell 5362
         3) Bryant CBRS20
         4) Leviton 5362S
         5) Legrand P&S 5362
         6) Or equal.
   2. Ground Fault Circuit Interrupter (GFCI) Receptacle:
      a. Cooper TWRSGF20
      b. Hubbell GFTWRST20
      c. Legrand P&S 2097TRWR
d. Or equal.
   3. Specification Grade USB Charger Tamper-Resistant Duplex - 20 Amp:
      a. Cooper TR7756
      b. Hubbell USB20X2
      c. Leviton T5832T
d. Legrand P&S TR5362USB
e. Or equal.
   4. Federal Specification Grade Plug Load Control Duplex Receptacle:
      a. Half Controlled, 20 amp:
         1) Legrand P&S 26352CH
         2) Leviton 163521P
         3) Hubbell DR20C1
         4) Legrand P&S PLT26351
         5) Or equal.
b. Dual Controlled, 20 amp:
         1) Legrand P&S 26352CD
         2) Leviton 163522P
         3) Hubbell DR20C2
         4) Or equal.
   5. Plug Load RF Controlled Duplex Receptacle:
      a. Half Controlled, 20 amp:
         1) Legrand P&S RF26352CH
         2) Or equal.
b. Dual Controlled, 20 amp:
         1) Legrand P&S RF26362DH
         2) Or equal.
c. RF Signal Pack:
         1) Legrand P&S RFP
         2) Wattstopper DLM WRC-TXLM
         3) Or equal.
C. Finish Plates:
   1. Bryant
   2. Cooper
   3. Hubbell
   4. Leviton
   5. Legrand P&S
   6. Or equal.

D. Wall Dimmers:
   1. Acuity Controls nLight Series
   2. Or equal.

E. Surface Covers:
   1. Aluminum with Gasket, Blanks, Single Gang:
      a. Bell 240-ALF
      b. Carlon
      c. Or equal.
   2. 2-Gang:
      a. Bell 236-ALF
      b. Carlon
      c. Or equal.
   3. While-in-Use Weatherproof Cover:
      a. Die Cast Cover:
         1) Intermatic
         2) Hubbell
         3) Cooper
         4) Or equal.
      b. Die Cast with Weatherproof Gasket:
         1) Bell 240-ALF
         2) Hubbell
         3) Cooper
         4) Or equal.

F. Provide lighting switches and receptacles of common manufacturer and appearance.

2.2 WALL SWITCHES

A. Characteristics: Decorative AC Rocker Switch Characteristics: Quiet acting, 20 amp, 120/277 volt, UL Listed for motor loads up to 80 percent of rated amperage.

B. Finish: White.

2.3 RECEPTACLES

A. Duplex Receptacles Characteristics: Straight parallel blade, 125 volt, 2 pole, 3 wire grounding.

B. Ground Fault Circuit Interrupter (GFCI) Receptacle: Feed through type, back-and-side wired, tamper-resistant, weather resistant self-testing, 20 amp, 125VAC.


E. Finish:
   1. Same exposed finish as switches.
   2. Receptacles installed in surface raceway to match raceway finish. See Section 26 05 33, Raceways.
   3. All automatically controlled, nonlocking type, 125 volt, 15 amp and 20 amp rated receptacles to be permanently marked by the manufacturer with the "universal power" symbol and the word "controlled."

2.4 FINISH PLATES
A. Finish Plates: Commercial grade thermoplastic with same finish as devices.
B. Provide telephone/signal device plates; activated outlets to have coverplates to match modular jack.

2.5 WALL DIMMERS
A. Provide wall dimmers compatible with type of load controlled (i.e. line voltage, low voltage, 2-wire, 3-wire, 0-10v). Finish to match wall switches. Size dimmers to accept connected load. Do not cut fins. Where dimmers are ganged together, provide a single multi gang coverplate.
B. LED indicator dots show by what percentage controlled lighting is dimmed. Programmable settings for maximum and minimum trim settings, and rate of change in lighting levels.

2.6 SURFACE COVERS
A. Material: Galvanized steel, 1/2-inch raised industrial type with openings appropriate for devices installed on surface receptacles.
B. Cast Box and Extension Adaptors: Aluminum with gasket, blanks single gang or 2-gang.
C. While-in-Use Weatherproof Cover: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord cap with bottom aperture for cord exit.
   1. Die cast cover with closed cell neoprene foam gasket: Capable of being locked closed to prevent tampering or unauthorized use.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS
A. See Architectural elevations for location and mounting height of wiring devices. Review Architectural elevations prior to rough-in and contact Architect immediately if conflicts are found between Architectural and Electrical Drawings. Do not rough-in devices until conflicts are resolved.
B. Install wiring devices and finish plates plumb with building lines, equipment cabinets and adjacent devices. Devices not plumb will be fixed at no additional cost to Owner.
C. Orientation:
   1. Install wiring devices with long dimension oriented vertically at centerline height shown on drawings or as specified.
   2. Vertical Alignment: When more than one device is shown on drawings in close proximity to each other, but at different elevations, align devices on a common vertical center line for best appearance. Verify with Architect.
   3. Horizontal Alignment: When more than one device is shown on drawings in close proximity to each other with same elevation, align devices on a common horizontal center line for best appearance. Verify with Architect.

D. Provide labeling per Section 26 05 53, Identification for Electrical Systems.

E. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

3.2 WALL SWITCHES INSTALLATION

A. At time of substantial completion, replace those items which have been damaged.

3.3 RECEPTACLES INSTALLATION

A. Upon installation, adhere to proper and cautious use of convenience receptacles. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty receptacles or cord caps.

B. GFCI Receptacles: One GFCI receptacle may not be used to provide GFCI protection to downstream duplex receptacles on the same branch circuit.

C. Provide a split wired receptacle or one controlled receptacle within 6 feet of each uncontrolled receptacle for the following areas: Offices, reception lobbies, conference rooms, kitchens, copy rooms.

3.4 FINISH PLATES INSTALLATION

A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

3.5 WALL DIMMERS INSTALLATION

A. Install per manufacturer's recommendations and wiring diagrams.

3.6 SURFACE COVERS INSTALLATION

A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

END OF SECTION
SECTION 26 28 00
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Fuses
   2. Molded Case Circuit Breakers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.
   2. Product data and time/current trip curves for circuit breakers supplied to project.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fuses:
   1. Bussmann
   2. Ferraz-Shawmut
   3. Littelfuse
   4. McGraw-Edison
   5. Or equal.
B. Molded Case Circuit Breakers:
   1. Eaton Electrical
   2. General Electric
   3. Siemens
   4. Schneider Electric/Square D
   5. Or equal.

2.2 FUSES

A. Characteristics:
   1. Dual element, time delay, current limiting, nonrenewable type, rejection feature.
   2. Combination Loads: UL Class RK1, RK5, or J, 1/10 to 600 amp. UL Class L, above 600 amps.
   3. Motor Loads: UL Class RK5, 1/10 to 600 amp.
   4. Fuse pullers for complete range of fuses.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. 1-, 2- or 3-pole bolt-on, single handle common trip, 600VAC or 250VAC as indicated on Drawings.

B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.

C. Calibrate for operation in 40 degrees C ambient temperature.

D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.

E. 151 to 400 Amp Breakers: Adjustable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

F. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.

G. Provide ground fault function for breakers greater than 800 amps where applied at 480 volts line-to-line; and where indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination:
   1. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
   2. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplate rating.
B. Install all items in accordance with manufacturers written instructions.

3.2 **FUSES**

A. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:
   1. 0 to 24: Provide 6 spare.
   2. 25 to 48: Provide 9 spare.
   3. 49 and Above: Provide 12 spare.

3.3 **MOLDED CASE CIRCUIT BREAKERS**

A. Provide testing of ground fault interrupting breakers.

B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.

C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.

D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.

E. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

F. Provide multi-pole branch circuit breakers for multiwire branch circuits for simultaneous disconnection of circuits.

**END OF SECTION**
SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Toggle Type Disconnect Switches
   3. Safety Switches
   4. Enclosed Circuit Breakers
   5. Molded Case Switches

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

B. In addition, reference the following:
   1. Section 26 24 16, Panelboards.
   2. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and
   Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330,
   Submittal Procedures.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section
   01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic
   Requirements and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toggle Type Disconnect Switches:
   1. Cooper
   2. Hubbell
   3. Leviton
4. Pass & Seymour
5. Slater
6. Or equal.

B. Manual Motor Starters:
   1. Eaton Electrical
   2. General Electric
   3. Siemens
   4. Schneider Electric/Square D
   5. Or equal.

C. Safety Switches:
   1. Eaton Electrical
   2. GE Industrial
   3. Siemens
   4. Schneider Electric/Square D
   5. Or equal.

D. Enclosed Circuit Breakers:
   1. Eaton Electrical
   2. GE Industrial
   3. Siemens
   4. Schneider Electric/Square D
   5. Or equal.

E. Molded Case Switches:
   1. Eaton Electrical
   2. General Electric
   3. Siemens
   4. Schneider Electric/Square D
   5. Or equal.

2.2 TOGGLE TYPE DISCONNECT SWITCHES

A. Rating: 120 or 277 volt, 1 or 2 pole, 20 amp, 1 hp maximum.

B. Enclosure:
   1. NEMA 1: Dry locations/Indoors.
   2. NEMA 3R: Damp or wet locations/Outdoors.

C. Handle lockable in 'off' position.

2.3 MANUAL MOTOR STARTERS

A. Quick-Make, Quick-Break. Thermal overload protection. Device labeled with maximum voltage, current, and horsepower.

B. Enclosure:
   1. NEMA 1: Dry locations/Indoors.
   2. NEMA 3R: Damp or wet locations/Outdoors.
2.4  SAFETY SWITCHES

A. Heavy duty fusible type and non-fusible type (as indicated on drawings), dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted.

B. Clearly marked for maximum voltage, current, and horsepower.

C. Operable handle interlocked to prevent opening front cover with switch in 'on' position.

D. Switches rated for maximum available fault current.

E. Handle lockable in 'off' position.

F. Enclosure:
   1. NEMA 1: Dry locations/Indoors.
   2. NEMA 3R: Damp or wet locations/Outdoors.

G. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class R or J fuses up to 600 amp. Remove if circuit breaker type is used. Provide switches of 30 to 200 amp with plug-on line side connections.

H. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse Clips: Designed to accommodate Class L fuses. Provide with shunt-trip and ground fault capabilities. Remove if circuit breaker type is used.

2.5  ENCLOSED CIRCUIT BREAKERS

A. Molded case circuit breakers:
   1. 1-, 2-, or 3-pole bolt on, single-handle common trip, 600VAC or 250VAC as indicated on drawings.
   2. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
   3. Calibrate for operation in 40C ambient temperature.
   4. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.
   5. 151 to 400 Amp Breakers: Variable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.
   7. Provide handle mechanisms that are lockable in the open (off) position.
   8. Circuit breakers to have minimum symmetrical interrupting capacity as indicated on Drawings.

B. Enclosure:
   1. NEMA 1: Dry locations/Indoors.
2. NEMA 3R: Damp or wet locations/outdoors.

2.6 MOLDED CASE SWITCHES

A. Removable cover, galvanized steel enclosure, powder coat painted.

B. Provide cover padlock provision.

C. Provide trip unit with no overcurrent, overload, or low level fault protection. Trip unit to be high instantaneous magnetic fixed trip type with magnetic trip reset at factory to interrupt high fault currents at or above preset level.

D. Enclosure:
   1. NEMA 1: Dry locations/Indoors.
   2. NEMA 3R: Damp or wet locations/Outdoors.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.

B. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to switches, fuses and circuit breakers as necessary to coordinate with the nameplate rating

C. Install in accordance with manufacturer's instructions.

D. Provide engraved nameplates per Section 26 05 53, Identification for Electrical Systems.

E. Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

3.2 TOGGLE TYPE DISCONNECT SWITCHES

A. Install fuses in fusible disconnect switches. Coordinate fuse ampere rating with installed equipment. Do not provide fuses of lower ampere rating than motor starter thermal units.

B. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

C. See General Installation Requirements above.

3.3 MANUAL MOTOR STARTERS

A. Provide disconnecting means within sight of each motor controller and of each motor. Motor controller disconnecting means equipped with lock-out/tag-out padlock provisions do not require a disconnect switch at the controlled motor location. Locate disconnect means in view of and not inside of equipment, such that tools are not needed to remove covers to access the disconnecting means.
B. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

C. See General Installation Requirements above.

3.4 SAFETY SWITCHES

A. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

B. See General Installation Requirements above.

3.5 ENCLOSED CIRCUIT BREAKERS

A. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

B. See General Installation Requirements above.

3.6 MOLDED CASE SWITCHES

A. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

B. See General Installation Requirements above.

END OF SECTION
SECTION 26 33 23
CENTRAL BATTERY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Components
   2. Accessories

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Include battery product data.
   2. Shop drawings to include battery interconnection schematic diagrams, block diagrams of interconnection of internal elements, input terminals and output circuit breakers.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Manufacturer qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience with service facilities within 100 miles of project.

1.6 WARRANTY

A. Warranty of materials and workmanship as outlined in Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

1.7 SYSTEM DESCRIPTION

A. Modular battery source inverter system complete with charger, transfer mechanism, integral maintenance bypass and output circuit breakers for purpose as emergency egress lighting backup power sources.
B. IGBT-based, PWM inverter, 16 kHz switch speed. Suitable for HID, fluorescent and incandescent loads. Recombinant VRLA batteries.

C. Provide two classes of output, one continuously energized, one energized only upon failure of input source.


1.8 PERFORMANCE

A. Environmental Conditions Required: 68 to 85 degrees F for batteries.

B. Minimum throughput efficiency: 86 percent.

C. Maximum Audible Noise: 52dBA.

D. Maximum THD: less than 10 percent at full resistive load.

E. Unit Power Capacity: 1.5 and 3.0 KW.

F. Unit Input Voltage: 120 and 277 volts, single-phase, 2-wire.

G. Inverter output frequency: 60 Hz plus 1 percent.

H. Unit Output Voltage: 120 and 277 volts, single-phase, 2-wire.

I. Maximum recharge time: 12 hours following 1.5 hour discharge.

J. Physical Size: Maximum 30-inches wide by 47-inches high by 25-inches deep per cabinet. Two cabinets for unit power capacity cited above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Chloride - Synthesis Series

B. On-Line Power Powerware Series

C. Controlled Power Company (CPC)

D. Myers Power Products

E. Or approved equivalent.

F. Basis of Design: Battery source inverter system on drawings is designed based on Myers Power Products product line. Approved manufacturers are allowed on condition of meeting specified conditions including available space for equipment (including Code required working clearances) Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.
2.2 COMPONENTS

A. Cabinet:
   2. Corrosion resistant paint finish.
   3. Hinged, lockable doors.

B. Inverter:
   1. Pulse-width modulated power supply based on IGBT transistors. Dual-conversion with no interruption to load.
   2. Internal maintenance bypass switch, make-before-break.
   3. Overload protection by static bypass switch; system rated to 42,000A symmetric short circuit.
   4. Visual indicator (LED) to indicate inverter operation.
   5. Each module protected against reverse battery polarity.
   6. Each module includes an encapsulated ferroresonant transformer, UL Class H insulation.

C. Charger:
   1. Dual rate design. Constant current voltage limited high rate charge followed by precision float voltage charge for maximum battery capability and life. Charger is temperature compensating to prevent thermal runaway condition with batteries.
   2. Capable of fully recharging batteries within 12 hours following any rated discharge.
   3. Reverse polarity protected.
   4. Provide fuse protection for system DC input and charger AC input and DC output.

D. Monitor:
   1. Monitor AC input for brownout or failure condition. Transfer to battery source when AC input voltage drops below 80 percent of nominal voltage.
   2. Transfer time 30 to 80 milliseconds.
   3. Low battery voltage shutdown set at 87.5 percent of nominal voltage.

E. Return to Normal Source: Two-minute time delay return to normal source once normal source has been reestablished.

F. Recombinant VRLA Batteries: Sufficient capacity to output voltage of the inverter for a period of at least 90 minutes at a rated load, without dropping below 87.5 percent nominal battery voltage. 10-year, sealed, lead-calcium. Requires no addition of water over life of battery. Construct case and cover of polypropylene, contain low-pressure safety release vents, and be non-gassing in normal use. 10-year design life expectancy at 77 degrees F. VRLA batteries to include self-sealing flame-arresting caps.

G. Output Regulation:
   1. 60 Hz plus or minus 1 Hz.
   2. Voltage regulation, plus or minus 6 percent or less from 0 percent to 100 percent of rated load.
2.3 ACCESSORIES

A. Status and Alarm Condition Monitor:
   1. LCD Display to Include:
      a. AC input voltage.
      b. DC charger current.
      c. Output power VA.
      d. AC output amps.
      e. DC battery voltage.
      f. System temperature.
      g. Output frequency.
   2. Test switch to allow manual test of system without interrupting power to load.
   3. Audible alarm and silence switch to monitor charger and inverter malfunctions and battery electrolyte level.

B. Output circuit breakers, including normally on circuit breakers, as indicated on drawings.

C. Self-Diagnostics:
   1. System to test for 5 minutes every 30 days and for 30 minutes every 6 months. An audible and visible alarm to activate upon:
      a. Utility failure.
      b. High temperature.
      c. Inverter failure.
      d. Charger failure.
      e. System overload.
      f. Output trip alarm.
   2. Output to cell phone or pager for notices to Owner during alarm and trouble conditions.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturer's instructions.

B. Provide a level dry protected area with stable temperature conditions. Install units plumb and level.

C. Batteries: Install batteries with acid neutralization pillow installed under each battery housing (comply with IFC 608.5.2 or local adopted Fire Code, whichever is more stringent). Enviroguard VRLA Pads or approved equal.

D. Room installation: Provide room containing central battery system with signage, automatic smoke detection tied to central system (see Division 28) as required by IFC Section 608 or local adopted Fire Code, whichever is more stringent.

E. Schedules:
   1. Provide output circuit schedule indicating loads connected to each output circuit breaker.

F. Training:
1. Provide Owner with minimum 4-hour training session, presented by factory technician, on use and maintenance of battery power system. Videotape training session for future use by Owner.

2. Verify operation of each unit by simulating outage.

G. Verify operation of each unit by simulating outage.

3.2 COMPONENTS

A. Install per manufacturers written instructions and requirements.

B. See General Installation Requirements above.

C. Provide interconnection between cabinets. Secure cabinets with seismic restraint in accordance with IBC seismic zone classification of area. Confirm requirements with Architect.

D. Comply with manufacturer's recommendations prior to start-up to prevent physical and electrical damage to components.

3.3 ACCESSORIES

A. Install per manufacturers written instructions and requirements.

B. See General Installation Requirements above.

C. Connect page, cell phone to dial phone number as directed by Owner, printing out status report during alarm or trouble condition.
   1. Utility power is lost.
   2. Fire alarm system goes into alarm.
   3. Security system goes into alarm

END OF SECTION
SECTION 26 51 00
LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Luminaires
   2. LED Drivers
   3. Lamps

B. Provide wiring for complete and operating lighting system.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Section 01410, Regulatory Requirements.

B. In addition, meet the following:
   1. NECA 500 - Commercial Lighting.
   2. UL 8750 – Light Emitting Diode (LED) equipment for use in lighting products.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Submit:
      a. LED Luminaires: Electrical ratings, dimensions, mounting, material, clearances, terminations, wiring, connection diagram, LM-79 photometric data, LM-80 lumen depreciation data.
      b. LED Drivers
      c. Lamps
   2. Submittal Cutsheets: Highlight, circle or otherwise graphically indicate which option(s) are being selected for the products submitted. Cutsheets that are not edited to indicate which products and options are submitted for this project or that list only catalog numbers to identify submitted options are not acceptable.
   3. Specified manufacturers are approved to submit bid. However, inclusion does not relieve manufacturer from supplying product as described.
   4. Provide the following operating and maintenance instructions as required by Section 26 00 00, Electrical Basic Requirements:
      a. Luminaires
      b. LED Drivers
      c. Lamps
1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet the following:
   1. Provide luminaires acceptable to code authority for application and location installed.
   2. Comply with applicable ANSI standards.
   3. Comply with applicable NEMA standards.
   4. Provide luminaires and lampholders that comply with UL standards and have been listed and labeled for location and use indicated by a testing agency acceptable by the AHJ (e.g., UL, ETL, and the like).
   5. Comply with CEC as applicable to installation and construction of luminaires.
   6. Comply with fallout and retention requirements of CBC for diffusers, baffles, and louvers.
   7. Provide LED luminaires from the same manufacturer and manufacturing LED source batch for similar applications (e.g., all LED downlights from a single manufacturer and batch, all linear LED products from single manufacturer and batch).

1.6 WARRANTY

A. Warranty as required by Section 26 00 00, Electrical Basic Requirements and Section 01740, Warranties/Guaranties.

B. In addition, provide:
   1. LED Luminaire Manufacturer's Warranty: Not less than 5 years for luminaire based on date of substantial completion. Includes normal cost of labor to replace luminaire. Replacement luminaire will match physical dimensions, physical appearance, chromaticity, lumen output and photometric characteristics of original installed equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Luminaires:
   1. Reference description and manufacturers in Luminaire Schedule on Drawings.
   2. Or equal.

B. LED Drivers:
   1. Indoor Drivers:
      a. eldoLED Series
      b. Advance/Philips
      c. Osram Sylvania
      d. Or equal.
   2. Outdoor Drivers:
      a. Advance/Philips
      b. Osram Sylvania
      c. LG
d. Or equal.

C. Lamps:
   1. LED (Light Emitting Diode) Lamps:
      a. Nichia
      b. Cree
      c. Osram Sylvania
      d. GE Lumination
      e. Or equal.
   2. Unless specific manufacturer not shown on this list is indicated in the Luminaire Schedule.
   3. Special types as indicated in Luminaire Schedule.
   4. Or equal.

2.2 LUMINAIRES

A. Luminaires: Reference description and manufacturers in Luminaire Schedule on drawings.

B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.

C. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet location.

D. Suspended luminaires: Provide minimum 24-inch adjustability in aircraft cable length where used.

E. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper factory trim and frame for luminaire to fit location and ceiling material. Verify with Architectural Reflected Ceiling Plan prior to submittals.

F. Finishes:
   1. Manufacturer's standard finish (unless otherwise indicated) over corrosion resistant primer.
   2. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectance.
   3. Exterior Finishes: As detailed in Luminaire Schedule or on drawings. Refer cases of uncertain applicability to Architect for resolution prior to release for fabrication.

G. Light Transmitting Components:
   1. Plastic diffusers, molded or extruded of 100 percent virgin acrylic.
   2. Prismatic acrylic, extruded, flat diffusers, 0.125-inch overall thickness, unless otherwise noted.

H. LED Luminaires:
   1. UL listing of luminaire includes drivers, transformers, enclosures, rated wire, communications devices and accessories needed for a complete and functional system.
   2. LM-79: Testing and measurement of absolute photometry, chromaticity (CCT) and luminaire power. Report provided by DOE certified independent testing laboratory. CCT as specified in Luminaire Schedule.


5. LEDs in one module/luminaire: Supplied from same batch/bin and fall within 3-step MacAdam Ellipse, or as described in Luminaire Schedule, whichever is the more stringent requirement.

6. Provide luminaires with integral LED thermal management system (heat sinking).

7. Luminaires to be equipped with an LED driver that accepts 120V through 277V, 50Hz to 60Hz (universal). Component-to-component wiring within the luminaire will carry no more than 80 percent of rated current and be listed by UL for use at 600VAC at 302 degrees F/150 degrees C or higher. Plug disconnects to be listed by UL for use at 600VAC, 15A or higher.

8. Provide luminaires with individual LED arrays/modules and drivers that are accessible and replaceable from exposed side of the luminaire.

### 2.3 LED DRIVERS

#### A. General:

1. Performance: Meet dimming range called out in Luminaire Schedule, free from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

2. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

3. Minimum efficiency of 85 percent, power factor greater than or equal to 0.90, compliance with reduction of hazardous substances (RoHS). Rated for operating temperature range of area in which driver is installed.

4. Limit inrush current to minimize breaker tripping.
   b. Preferred Specification: Meet or exceed 30 milliamp-squared-seconds at 277VAC for up to 50 watts of load and 75 amps at 240 microseconds at 277VAC for 100 watts of load.

5. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

6. No visible change in light output with a variation of plus/minus 10 percent line voltage input.

7. Total Harmonic Distortion less than 20 percent percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD at no point in the dimming curve allows imbalance current to exceed full output THD.

8. Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
   a. Adjustment of forward LED voltage, supporting 3V through 55V.
   b. Adjustment of LED current from 150mA to 1.4A at the 100 percent control input point in increments of 1mA.
c. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

9. Operate for a (+/- 10 percent) supply voltage of 120V through 277VAC at 60Hz.
10. UL Recognized under the component program and modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
11. Ability to provide no light output when the analog control signal drops below 0.3 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control dead band between 0.3V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in luminaire to luminaire output.

B. Light Quality:
1. Over the entire range of available drive currents, driver to provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 percent to 1 percent light output and step to 0 percent where indicated. Driver to respond similarly when raising from 0 percent to 100 percent.
   a. Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
2. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.
3. Drivers to track evenly across multiple luminaires at all light levels, and must have an input signal to output light level that allows smooth adjustment over the entire dimming range.
4. Driver and luminaire electronics to deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100 percent to 0.1 percent luminaire will have:
   a. LED dimming driver to provide continuous step-free, flicker free dimming similar to incandescent source.
   b. Base specification: Based on IEEE PAR1789, minimum output frequency should be greater than 1250 Hz.
   c. Preferred specification: Flicker index to be equal to incandescent, less than 1 percent at all frequencies below 1000 Hz.

C. Control Input:
1. Provide control protocol to match lighting control system specified for use with luminaire.
2. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers:
   b. Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
   c. Meet ESTA E1.3 for RGBW LED drivers.

2.4 LAMPS

A. Provide lamps for luminaires.
B. Provide lamp catalogued for specified luminaire type.

C. Incandescent Lamps: Not allowed unless noted in Luminaire Schedule.

D. LED (Light Emitting Diode):
   1. LED manufacturer will include, but not be limited to, light source, luminaire, power supply and control interface with added components as needed for complete and functioning system.
      a. Comply with ANSI chromaticity standard for classifications of color temperature. See Luminaire Schedule for specified LED lamp color and color temperature. UL or ETL listed and labeled.
      b. Luminaire testing per IESNA LM-79 and LM-80 procedures.
      c. Lamp life for white LEDs: 50,000 plus hours with lamp failure occurring when LED produces 70 percent of initial rated lumens.
      d. Lamp life for color LEDs: 30,000 plus hours with lamp failure occurring when LED produces 50 percent of its initial rated lumens.
      e. LED Drivers: Reverse polarity protection, open circuit protection, require no minimum load. Minimum 80 percent efficiency. Class A noise rating.
      f. Dimming: LED system capable of full and continuous dimming.
      g. Correlated Color Temperature (CCT): See Luminaire Schedule for selection of color temperature for each luminaire. Ranges given below reflect maximum allowable tolerances for color temperature range for each nominal CCT.
         1) Nominal CCT:
            a) 2700 K (2725 ± 145)
            b) 3000 K (3045 ± 175)
            c) 3500 K (3465 ± 245)
            d) 4000 K (3985 ± 275)
      h. Color Rendering Index (CRI) to be greater than or equal to 80.
   2. Special types as indicated in Luminaire Schedule.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's written installation instructions and requirements.

B. Install luminaires securely, in neat and workmanlike manner.

C. Install luminaires of types indicated where shown and at indicated heights in accordance with manufacturer's written instructions and with recognized industry practices to ensure that luminaires comply with requirements and serve intended purposes.

D. Wiring:
   1. Recessed luminaires to be installed using flexible metallic conduit with luminaire conductors spliced to branch circuit conductors in nearby accessible junction box over ceiling. Junction box fastened to building structural member within 6-feet of luminaire.
   2. Luminaires for lift out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.
3. Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.
4. Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.

E. Relamp luminaires which have failed lamps at substantial completion.

F. Replace LED drivers deemed as excessively noisy by Architect, Engineer, or Owner.

G. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

H. Support luminaires larger than 2- by 4-foot size independent of ceiling framing.

I. Locate recessed ceiling luminaires as indicated on architectural reflected ceiling plan.

J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

K. Exposed Grid Ceilings:
   1. Support surface mounted luminaires in grid ceiling directly from building structure.
   2. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.
   3. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.

L. Install recessed luminaires to permit removal from below.

M. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

N. Install clips to secure recessed grid-supported luminaires in place.

O. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Architectural Drawings.

P. Install accessories furnished with each luminaire.

Q. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

R. Bond products and metal accessories to branch circuit equipment grounding conductor.

S. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

T. Where manufactured wiring assemblies are used, ensure that wiring assembly manufacturer sends components to appropriate luminaire manufacturer for respective installation of proper components.

U. Coordination:
1. **Coordination of Conditions:** Coordinate ceiling construction, recessing depth and other construction details prior to ordering luminaires for shipment. Refer cases of uncertain applicability to Architect for resolution prior to release of luminaires for shipment. Where luminaires supplied do not match ceiling construction, replace luminaires at no cost to Owner.

2. **Electrical drawings are schematic,** identifying quantity and type of luminaires used and their approximate location, but are not to be used for dimensional purposes. Reference architectural drawings for exact locations, including mounting heights.

3. **Provide lighting indicated on drawings with luminaire of the type designated and appropriate for location.**

4. **Provide LED luminaires with driver compatible to lighting control system as shown in drawings and as specified.**

5. Where remote drivers are required, ensure adequate accessibility to driver. Upsize conductors between luminaire and driver to accommodate voltage drop.

### V. Field Quality Control:

1. Perform field inspection in accordance with Section 01400, Quality Control Requirements.

2. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

### W. Cleaning:

1. Clean electrical parts to remove conductive and deleterious materials.

2. Remove dirt and debris from enclosures.

3. Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.

4. Clean photometric control surfaces as recommended by manufacturer.

5. Clean finishes and touch up damaged finishes per by manufacturer's instructions.

### X. Demonstrate luminaire operation for minimum of two hours.

#### 3.2 LUMINAIRES

**A.** Install per manufacturer's written installation instructions and requirements.

**B.** Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.

**C.** Avoid interference with and provide clearance from equipment. Where indicated locations for luminaires conflict with locations for equipment, change locations for luminaire by minimum distance necessary as directed by Architect.

**D.** Suspended Luminaires: Mounting heights indicate clearances between bottom of luminaire and finished floors.

**E.** Emergency Egress Luminaires: Provide unswitched circuit for battery charging and autotransfer circuiting for exit signs and luminaires with integral batteries. Where test switch cannot be integral to luminaire, mount remote test switch flush-to-ceiling and adjacent to egress luminaire.

**F.** Interior Luminaire Supports:
1. Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.
2. Maintain luminaire positions after cleaning and relamping.
3. Support luminaires without causing ceiling or partition to deflect.
4. Provide mounting supports for recessed and pendant mounted luminaires as required by CBC.

G. Adjusting:
   1. Aim and adjust luminaires as indicated.
   2. Focus and adjust floodlights, spotlights and other adjustable luminaires, with Architect, at such time of day or night as required.
   3. Align luminaires that are not straight and parallel/perpendicular to structure.
   4. Position exit sign directional arrows as indicated.

3.3 LED DRIVERS

A. Install lamps per manufacturer's installation instructions and requirements.

B. Where driver is remote mounted, size wiring based on type of driver, driver distance from luminaire, and voltage/power level, and manufacturer's installation instructions.

C. Protect 0-10V input from line voltage mis-connection, and so it will be immune and the output unresponsive to induced AC voltage on the control leads.

END OF SECTION
SECTION 27 00 00
COMMUNICATIONS GENERAL

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes general information that applies to all Division 27 specifications.

B. Contractor shall furnish and install a Structured Cabling System including, but not necessarily limited to, copper cabling for the voice, data and wireless systems.

C. Contractor shall provide and install all materials and hardware necessary for a complete cabling system within parts of the renovation including any necessary accessory hardware in the existing telecommunications equipment rooms referenced in the drawing set accompanying these specifications.

D. Provide a certified Structured Cabling System with a 25-year Category 6 channel performance compliance warranty.

E. Contractor shall be a Certified Installation Company of the Structured Cabling System manufacturer.

F. Related Sections:
   1. 270820: Copper Testing
   2. 271500: Communications Horizontal Cabling
   3. 271600: Communications Connecting Cords Devices & Adapters

1.02 REFERENCES – TO BE CONSIDERED AS A PART OF THIS SPECIFICATION

A. Most recent editions and addenda of the following documents:

B. Contra Costa Community College District – Districtwide Technology Infrastructure Standard

C. TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

D. TIA-526-14-B Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 edition 2, Fibre-Optic Communications Subsystem Test Procedure-Part 4-1: Installed cable plant- Multimode attenuation measurement

E. TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises

F. TIA-568-C.1 Commercial Building Telecommunications Cabling Standard

G. TIA-568-C.2 Balanced Twisted Pair Cabling Components

H. TIA-568-C.3 Optical Fiber Cabling Components Standard

I. TIA-568-C.4 Broadband Coaxial Cabling and Components Standard
J. ANSI/TIA/EIA 569-B Commercial Building Standards For Telecommunications Pathways And Spaces
K. TIA-598-C Optical Fiber Cable Color Coding
L. ANSI/TIA/EIA 606-B The Administration Standard For The Telecommunications Infrastructure Of Commercial Building
N. ANSI/TIA--607-B & B1 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
O. TIA-758-B Customer-Owned Outside Plant Telecommunications Infrastructure Standard
P. ANSI/TIA/EIA-862 Building Automation Systems Cabling Standard for Commercial Buildings
Q. ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers
R. TSB-4979 - Practical Considerations for Implementation of Encircled Flux Launch Conditions in the Field. This bulletin outlines precise specifications that define the launch condition of test sources into multimode fiber which have been standardized and are mandatory for testing optical attenuation of installed multimode cabling per TIA-568.
S. BICSI Telecommunications Distribution Methods Manual (TDMM) 11th Edition
T. BICSI Information Transport Installation Manual (ITSM)
W. ISO/IEC 11801 – Information Technology – Generic Cabling for Customer Premise
X. IEEE 802.3 Standard for Information technology -Telecommunications and information exchange between systems - Local and metropolitan area networks – Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
AA. NECA/BICSI-568-A Standard for Installing Commercial Building Telecommunications Cabling
BB. NESC – National Electrical Safety Code
CC. Federal Communications Commission Part 15 and Part 68

DD. UL 444 – Standard for Safety of Communications Cable

EE. UL 1666 – Standard for Safety of Flame Propagation Height

FF. NFPA 262 – Flame Travel and Smoke of Wires and Cables

GG. IBC 714.3.2

HH. ASTM E 814 / UL 1479

II. Local Authority Having Jurisdiction

1.03 DEFINITIONS / TERMS / ACRONYMS

A. ANSI American Northern Standards Institute

B. AWG American Wire Gauge

C. BICSI Building Industry Consulting Service International

D. BCT Bonding Conductor for Telecommunications

E. COTS Common Off The Shelf Technologies

F. EIA Electronics Industry Alliance

G. ETL Intertek Semko Labs

H. FCC Federal Communications Commission

I. GE: Grounding Equalizer

J. IEC International Electrotechnical Commission

K. IEEE Institute of Electrical and Electronic Engineers

L. IDC Insulation displacement contact

M. ISO International Standards Organization

N. J-STD Joint Standard

O. NECA National Electrical Contractors Association

P. NFPA National Fire Protection Agency

Q. NRTL Nationally Recognized Testing Laboratory

R. SC TIA Standard duplex connector
S. TIA Telecommunications Industry Association

T. UL Underwriters Laboratory

U. As Necessary: That work which is required for completed construction, but is not necessarily shown or described in the Contract Documents.

V. As Required: That work which is required for completed construction and is shown on the drawings or described in the project Specification.

W. Cabling: Cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

X. Backbone: A facility (e.g., pathway, cable or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities and equipment rooms within or between buildings.

Y. Backbone Cabling: Cabling and connecting hardware that provides interconnections between telecommunications rooms, equipment rooms, and entrance facilities.


AA. Concealed: Hidden from sight, buried as in chases, furred spaces, shafts, fixed ceiling or embedded in construction.

BB. Contractor: The installation Contractor responsible for the furnishing and installation of all work indicated within this Specification.

CC. Construction Manager: The Owner’s appointed representative.

DD. Equipment Outlet (EO): A device also known as the outlet or information outlet placed at the user workstation for termination using connectors (jacks) of horizontal media for connectivity of data and voice at teacher work area outlet, multimedia equipment. These outlets provide the connection point to voice, data, and other media services.

EE. Exposed: Bare, open to the elements, out in the open, uncovered.

FF. Furnish: Purchase, supply, provide and deliver to the project site, protect and provide interim storage and be ready for unloading, unpacking, assembly, installation, and similar operations in accordance with Manufacturer’s specifications.

GG. GE Grounding equalizer: Employed in a multistory building to interconnect multiple TBBs on the same floor. Sized equal to TBB.

HH. Horizontal Cabling: Cabling between and including the work area outlet/connector and the horizontal cross-connect/patch cord in the telecommunications room.

II. Install: Describes operations at project site including the actual "unloading, unpacking, rigging in place, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".
JJ. Installer: Contractor, Subcontractor and/or supplier who uses their own employees for performance of all construction activity related to their specified responsibilities, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform and the "Installers" must be an authorized Manufacturers representative, certified, experienced and qualified to provide, install, program, troubleshoot, train, warrant and service all the systems in this section in their entirety.

KK. If Applicable: That work which may be required for completed construction at applicable locations, but is not necessarily shown or described in the Contract Documents.

LL. Owner: Person or entity for which the building and construction is being done; and/or that will take possession of the property once the construction is complete.

MM. Owner Representative: The person or entity representing the Owner on contractual matters.

NN. Product: Any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

OO. Provide: To "furnish and install, complete and ready for the intended use".

PP. RCDD: Registered Communications Distribution Designer (RCDD).

QQ. Substantial Completion: The project is sufficiently complete to be utilized for its intended use as stated in the body of this written Specification.

RR. TBB: Telecommunications Bonding Backbone

SS. TGB: Telecommunications Grounding Busbar

TT. TMGB: Telecommunications Main Grounding Busbar

UU. Words in the singular: Will also mean and include the plural, wherever the context so indicates, and words in the plural will mean the singular, wherever the context so indicates.

1.04 SUBMITTAL REQUIREMENTS

A. General
   1. Provide required submittals in accordance with Conditions of the Contract, and Division 1 Submittal Procedures Section.
   2. Format:
      a. For this section furnish submittal data neatly bound in an 8 1/2" x 11" folder or binder for each specification section with a table of contents listing materials by Section and paragraph number.
      b. Project name and address
      c. Number of submittal
      d. Name and address of the contractor
      e. Date of submittal
      f. Table of contents with material page numbers listed
      g. Page number of the corresponding specification or drawing numbers in the contract documents.
   3. Submittals to consist of:
a. Detailed shop drawings,
b. Product specifications,
c. Block wiring diagrams,
d. "Catalog cuts" and data sheets containing physical and dimensional information,
e. Performance data,
f. Electrical characteristics
g. Materials used in fabrication, and material finish.

4. Clearly indicate by arrows or brackets precisely what is being submitted on and those
optional accessories which are included and those which are excluded.

B. Material submittals
1. Label each submittal with the Specification Section Number and provide a cover letter or
   stamp stating that the submittal has been thoroughly reviewed by the Contractor and
   complies with the requirements of the Contract Documents. Failure to comply with this
   requirement will constitute grounds for rejection of data.
2. For each product, indicate where it is intended to be installed.
3. Resubmittals: Provide a cover letter with the resubmittal that lists the action taken and
   revisions made to each product submittal in response to Submittal Review Comments,
   indicating the page in the resubmittal that the new information occurs. Failure to
   include this cover letter will constitute rejection of the resubmittal package and no review
   will occur.

C. Under the provisions of this request for proposal, prior to the start of work the Structured
Cabling System Contractor will:
1. Submit copies of the certification of the company and names of staff that will be
   performing the installation and termination of the installation to provide proof of
   compliance of this spec.
2. Submit proof from Manufacturer of Contractor’s good standing in Manufacturer’s
   program where contractor is authorized by manufacturer to do warranted work.
3. Submit appropriate cut sheets and samples for all products, hardware and cabling.
4. Work will not proceed without the Owner's approval of the submitted items.
5. The Structured Cabling Systems Contractor will submit in writing any material
   substitutions they propose and receive approval from the Owners on all substitutions of
   material in writing prior to purchase and installation. No substituted materials will be
   installed except by written approval from the Owner.
6. Refer to other applicable sections for additional submittals requirements.

D. Submit a work plan for installation and testing of the structured cabling system, including time
lines for milestones, coordination with other trades, etc.

E. Shop drawings
1. Obtain electronic files containing the contract documents drawing files for use in
   preparing the shop drawings from the Engineer.
2. Use of CAD Files: Should the Contractor need the Engineer’s CAD files to produce shop
   drawings and/or as-built drawings, the Engineer requires the Contractor sign a CAD files
   release agreement.
3. Submit the following for review and approval prior to the installation of equipment:
a. Floor Plans: 1/8 inch scale floor and site plans showing the locations of devices
   and cable routing paths with cable types and quantity called out.
4. Submit Shop drawings for the entire structured cabling system, identifying such items as
   rack fills, cabling pathways and pathway fills, ladder and other cable raceways,
coordination with other trades, etc. These drawings and support narratives must completely describe the intended build for the project.

F. Provide Indexed Project Manual composed of Test Results, As-Built drawings, material cut sheets, maintenance instructions, Parts List (with part numbers) of all materials installed, etc., at the completion of project.

G. Certification letters from manufacturers of major system components stating the Contractor is an authorized reseller, installer, and extended warranty provider for the specified security systems.

H. Final close out documents including but not limited to bound indexed test results, project manual that includes such items as manufacturer and contractor warranties, product cut sheets, material submittals, etc.
   2. Hard copy documentation of test results for every cable segment and link in 3-ring binder. Documents will include measured values as well as whether or not the test passed.
   3. Provide "As-Built" Drawings on AutoCAD Version the same as provided by architect to the Owner. Obtain copy of original Drawings from the Architect.
      a. "As-Built" drawings indicating location of all equipment including but not limited to work area outlets, patch panels, cross connect blocks, on each segment and cable routing outlet and identifiers. Indicate labeling for each piece of equipment.
      b. Provide respective copies mounted in each telecommunications room, and the main cross connect.
      c. As-Built drawings will contain all installed cabling and materials. Outlets will be numbered with each cable associated with the work area outlet.
   4. Place a laminated ½ or full-size floor plan of these drawing (coordinate with Owner) on the wall of each communications room.

I. Submit NRTL certification that the structured cabling system meets the transmission requirements of TIA-568-C.0.

1.05 QUALITY ASSURANCE

A. The Telecommunications Subcontractor shall have total responsibility for the coordination and installation of the work shown and described in the telecommunications drawings and specifications. The Telecommunications Subcontractor shall be a company specializing in the design, fabrication and installation of integrated telecommunications systems.

B. Telecommunications Systems specified shall be engineered, assembled and installed under the direction of a pre-qualified Telecommunications Subcontractor. Pre-qualification requirements shall include submittal by the Telecommunications Subcontractor to the Architect of the following:
   1. List of previous projects of this scope and nature, including names and sizes of projects (to include square footage and construction cost – overall and that of the Telecommunications Subcontractor), description of work, times of completion, and names of contact persons for reference.
   2. Installers shall certify that they are manufacturer-authorized or trained for work to be performed.
C. The Installer (Firm and Employees) will be experienced in the operations they are engaged to perform. Demonstrate at least five years of continuous recent experience on similar projects. The Installer will hold recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed.

D. Provide names of contacts from the last five similar projects including the General Contractor, Owner's Representative, Architect and Engineer. Indicate project locations, scope and current phone numbers that the contacts can be reached at.

E. Qualified Structured Cabling System Installation firms will have demonstrable design and installation training with certifications of competence. Certified training will be industry recognized and at least equal to:
   2. Registered Communications Distribution Designer (RCDD).
   3. Manufacturer Certified Installer

F. Provide a full time on site foreman who personally has been certified as described above. Submit all documentation under this Section.

G. Provide an on-call Project Manager to supervise the project.

H. Each Foreman and Installer working on this project will be trained to the qualified level as specified by the Manufacturer(s) for installation and maintenance of equipment being provided on this project. The training will consist of at least a minimum of proper installation techniques of their specific equipment in order to have a complete operating system meeting or exceeding the requirements as specified herein. Each Foreman and Installer working on this project will have documentation from the Manufacturer indicating that they have been adequately trained prior to the start of the project. Only Foreman and Installers who have been properly trained and documented by the Manufacturer whose equipment is being provided on this project will be allowed to install.

I. Separate Qualifications Requirements:

J. Installers will be specifically qualified for each system being installed under this section. Provide documentation for each installer including:
   1. State of CA License as required
   2. Registered Telecommunications Installer Apprentice Certificate

K. Maintain at the site an updated copy of the Manufacturer Trained Installers list including a copy of their training documentation from the Manufacturer. This documentation will be made available to the Architect upon request.

1.06 BIDDER QUALIFICATIONS

A. Bidding Contractor shall be licensed to install telecommunications systems in the state where work will be performed.

B. Bidding Contractor shall have a minimum of 5 years of experience installing structured cabling for telecommunications.

C. Bidding Contractor shall have the capability to bond project in its entirety.
D. Bidding Contractor shall be able to provide insurance at the request of the owner.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Contractor shall ensure that materials delivery to work area shall be coordinated with construction site manager responsible for materials distribution to all trades.

B. Contractor is responsible for all materials, tools and vehicles left on the job site.

C. Contractor shall coordinate a disposal bin for the removal of all trash produced by the Contractor’s associated personnel during the project.

D. Contractor shall ensure materials are stored in an environmental area where:
   1. Temperature does not exceed 120 degrees Fahrenheit nor below 32 degrees Fahrenheit.
   2. Humidity does not exceed 80%.
   3. No direct exposure to sunlight.

E. Cable shall be stored according to Manufacturer’s recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable will be stored off site at the Contractor's expense.

F. Deliver equipment in individual shipping splits for ease of handling, mount on shipping skids and wrap for protection.

G. Inspect and report concealed damage to carrier within specified time.

H. Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation. Meet the requirements and recommendations of NFPA 70B and the Manufacturer. Location will be protected to prevent moisture from entering enclosures and material.

I. Handle in accordance with NEMA and the Manufacturer’s recommendations and instructions to avoid damaging equipment, installed devices and finish.

J. The equipment will be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer will be required to brace the equipment suitably to ensure that the tilting does not impair the functional integrity of the equipment.

1.08 PROJECT CONDITIONS

A. Environmental Requirements
   1. Contractor shall ensure that any pollutants produced during the work are disposed of according to local, state or national regulations. Follow the most stringent guidelines.
   2. It is preferred that the Communications Contractor recycle any used or un-used components during the course of the construction project.
   3. Coordinate with LEED project manager if cabling system or components will used for points in a LEED certified project.
B. Existing conditions
1. Prior to bid, Telecommunications Subcontractor is to visit the existing building and evaluate all existing conditions. Bring to the attention of the Owner and Design Team any cause for concern or apparent conflicts with the contract documents as soon as practically possible.
2. See Section 01 51 33 for Temporary Telecommunications requirements.

C. Field Measurements
1. Contractor shall coordinate with electrical engineer on project that the main electrical service ground has a resistance to earth of less than 5 ohms.
2. Contractor shall ensure that all grounding buss bars for all equipment network rooms shall have a resistance of less than 1 ohm back to the main electrical service ground.
3. Contractor shall ensure that all field testers have been calibrated from the Manufacturer within 1 year.
4. Refer also to grounding specification 27 05 26

1.09 PRE-CONSTRUCTION MEETING

A. If not called by GC contractor shall call a meeting with GC, Owner’s representative, design consultant, and others deemed necessary by Owner &/or GC.

B. At the meeting, project schedule and phasing will be discussed. In addition, any constructability issues, or questions about the bid documents will be presented verbally and in writing. This is in addition to the standard RFI process established by project manual.

1.10 SEQUENCING

A. Contractor shall coordinate with Owner’s project manager on sequencing of various trades and construction teams for the lifecycle of the project.

B. Cooperation and coordination with other trades.
1. The work will be so performed that the progress of the entire building construction, including all other trades, will not be delayed and not interfered with. Materials and apparatus will be installed as fast as conditions of the building will permit and must be installed promptly when and as directed.
2. Keep fully informed as to the shape, size and position of all openings required for all apparatus and give information in advance to build openings into the work. Furnish and set in place all sleeves, pockets, supports and incidentals.
3. Coordinate exact locations and roughing in dimensions of all work before installation and make all final connections as required. Any changes required to avoid interferences or to provide adequate clearances for Code and maintenance requirements will be made at no additional costs.
4. Structural elements of the project will not be relocated, altered or changed to accommodate the work without written authorization from the Owner/Architect.
5. Work that is installed before coordination with other trades or that causes interference with the work of other trades will be changed to correct condition at no additional cost to the Owner.
6. Obtain a complete set of Project Drawings and Specifications for coordination and to determine the full scope of work.
7. Attend project coordination meetings to coordinate work of this Section, pathways, work of other trades phasing and other project requirements.
1.11 CONTINUITY OF SERVICE AND SCHEDULING OF WORK

A. Contractor shall provide a detailed construction schedule with hard dates for completion of roughing in cables, terminations and testing once scheduling sequence has been determined to the Owner’s Project Manager.

B. Cabling schedule shall be in a software program designated by the Owner’s Project Manager.

C. Continuity of all services will be maintained in all areas that will be occupied or temporarily relocated during the construction period. If an interruption of service becomes necessary, such will be scheduled in advance, made only upon consent of the Owner and at a time outside normal working hours as the Owner will designate. The Contractor will schedule the shutdown with seven days in advance. Arrange work to minimize shutdown time.

D. Should services be inadvertently interrupted, immediately notify the Owner. Be prepared to immediately furnish labor, materials and the equipment necessary for prompt restoration of interrupted service.

E. Refer to the overall scheduling of the work of the project. Schedule work, process Submittals and order materials and equipment to conform to this schedule and install work to not delay nor interfere with the progress of the project.

F. Inform General Contractor and Architect immediately of any delays or potential delays. Furnish Manufacturer’s letter to verify order date, equipment delays, expected shipment date, order number, and potential remedies to speed up delivery. Any costs to speed up delivery will be implemented at no cost to the project if the equipment or material was not ordered as soon as possible after Contract award or within the time frames indicated with the Submittals.

G. Include premium time required to comply with the project scheduling and phasing.

H. Be aware of, and plan for, project scheduling and phasing. Provide for complete continuous operation of all systems. Coordinate scheduling and phasing with the Architect, Owner, other Trades, and the General Contractor.

I. Demolition of existing systems being updated will take place only after the new or replacement system is completely installed, operational, tested and certified. This work may be required on a "per-phase" basis.

1.12 LABELING

A. Label all major elements in communications infrastructure as defined in TIA 606B.

B. Document and place on full and half size set of plans all elements with their unique numbers.

C. Provide a definition or labeling matrix with As-Built/Document Close-Out submittals that defines each labeling element with examples of each field defined.

D. Submit complete labeling scheme for all elements with initial submittals for project.

E. Confirm with Owner prior to implementation, the proposed labeling scheme you are intending to implement.
F. Ensure labeling for backbone cables includes information on the space name/number of the cable’s opposite end. This requirement includes buss bar, bonding conductor, and bonding backbone cable labeling.

G. As a part of the close-out submittal package, provide riser cable and bonding conductors drawings (full and half size as well as editable soft copy) showing the cables, their installed routes, and the cable numbers. These documents will be in addition to the As-Built floor plan submittals that identify work area outlet placement with their respective identification numbers.

1.13 POST CONSTRUCTION

A. Meeting: Subsequent to substantial completion and testing, call a meeting with GC, Owner’s representative, design consultant, and others deemed necessary by Owner &/or GC.
   1. At the meeting, contractor shall present a DRAFT of AS-Built drawings, test results, and any other material contractor deems appropriate to completing the project for review by other attendees.
   2. Any comments or requests for correction shall be noted by the contractor during the meeting. Corrections to all documents shall be made and final copies shall be submitted within 1 week of meeting.

B. Punch Walk: Arrange with Owner’s project team, GC, and consultant a final punch-walk to review completed installation.
   1. Document all discussion, comments, and requests by Owner’s team, noting outstanding items that must be ameliorated.
   2. Complete all tasks on punch-list.

C. Notification of completion of work: Notify Owner in writing when installation is complete. Arrange for a site walk thru with the Owner demonstrate that all punch list items have been completed.
   1. Record any Owner comments on items that may have been left incomplete whether or not they were a part of punch list.
   2. Complete any outstanding items.

1.14 PROTECTION OF WORK AND PROPERTY

A. Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.

B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen will be replaced with equal material or equipment at the option of the Architect and Owner.

C. Materials and equipment stored for this project will be protected and maintained according to the Manufacturer’s recommendations and requirements and according to the applicable requirements of NFPA 70B.

D. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen and make good any damage caused.
E. Use caution to avoid damage to existing work, and to prevent harm to personnel working in all areas.

F. Observe all safety precautions and requirements for the construction.

G. The General Contractor and the Installer are responsible for initiating, maintaining, and supervising all safety precautions and requirements during construction.

H. Coordinate installations with all other trades in order to not damage equipment or cables during construction. Any work that is damaged during construction will not be repaired. Replace damaged work completely, with no splices in cabling, at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 REFER TO 27 15 00 FOR COMMUNICATIONS HORIZONTAL CABLING

2.02 REFER TO 27 16 00 FOR COMMUNICATIONS CONNECTING CORDS, DEVICES AND ADAPTERS

2.03 LABELING

A. Horizontal and grounding cabling: 1” white with black lettering. Dymo Rhino P/N 1734821
   1. Approved equal

B. Backbone cabling: 1” white nylon with black lettering: Dymo Rhino P/N 1734524
   1. Approved equal

C. Racks, patch panels, cabinets, fire stop systems: ½” white permanent polyester with black labeling. Dymo Rhino P/N 18483
   1. Approved equal

2.04 FIRE STOP

A. Provide thru-partition penetrations for all division 27 infrastructure that are listed systems for the intended purpose of the penetration.

B. Fire stop sleeves must not only be UL listed systems for installed locations but must also be designed to stop the passage of smoke through the device, by their design reduce or mitigate the passage of sound through the device, and to maintain the fire rating of the partition.
   1. Install fire stop systems that pass into spaces that are rated. Ensure system maintains partition’s fire and STC rating, while not de-rating or changing the sleeves’ UL Listing.

C. Per IBC 714.3.2, membrane penetrations firestop systems must be tested to ASTM E 814 / UL 1479
   1. Recessed fixtures shall be installed such that the required fire resistance will not be reduced.
   2. Sumtotal area of openings does not exceed 100 square inches for any 100 sq. ft. of wall.
   3. Steel electrical boxes, or steel boxes installed for Div. 27 infrastructure, installed on opposite sides of a wall must be separated by a horizontal distance greater than 24”.
D. Acceptable Manufacturers: Subject to compliance with requirements, provide products from manufacturers or approved equal as further defined in the Systems and Applications Schedule in Part 3 of this section.
1. Hilti
2. EZpath
3. 3M

2.05 CABLE SUPPORTS

A. Provide 3/8” threaded rod or drop wire for support of J-Hooks when conduit not utilized.
1. Acceptable manufacturer for drop wire hooks: Erico, or approved alternate, sized for cable bundles.
2. Drop Wire / Rod Securing Clip: Eaton B-Line BA311, or appropriate size for wire/rod size.
3. Utilize existing horizontal cabling pathways as possible throughout the renovated areas of the project
   a. If existing horizontal cabling pathways appear to be damaged or no longer grounded and bonded, provide the necessary repairs to the horizontal cabling pathway and ensure proper bonding and grounding of the telecommunications system.

2.06 CABLE LUBRICANT

A. Acceptable Manufacturer
   1. Maxlub
   2. Approved alternate

B. Acceptable Product
   1. MXC-Lube-35LR
   2. MXC-Lube-D20

C. Product Requirements
   1. Rated for fiber, and copper cables
   2. Compatible with common cable jackets including Polyethylene
   3. Rated for OSP, riser, and Plenum applications
   4. Non-staining

PART 3 - EXECUTION

3.01 GENERAL

A. Verify the exact location prior to bid of all items that may be indicated and determine exact location of all electrical items that are not indicated on the Drawings.

B. Include the cost of all work including sub-letting of any work that may be required to complete the work indicated in order to avoid work stoppages and jurisdictional disputes. The work to be sublet will conform to precedent agreements and decisions of record. Jurisdictional assignment will be a responsibility under this Section's contractual obligation.

C. Do not install equipment and materials that have not been reviewed by the Architect. Equipment and materials which are installed without the Architect's review or without
complying to comments issued with the review will be removed from the project when so
instructed by the Architect. No payment will be made for unapproved or removal if it is
ordered removed. The Installer will be responsible for any ancillary costs incurred because of
its removal and the installation of the correct equipment and materials.

D. Obtain detailed information on installation requirements from the Manufacturers of all
equipment to be furnished, installed or provided. At the start of construction, check all
Contract Documents, including all Drawings and all Sections of the specifications for
equipment requiring electrical connections and service and verify electrical characteristics of
equipment prior to roughing.

E. Equipment and systems will not be installed without first coordinating the location and
installation of equipment and systems with the General Contractor and all other Trades.

F. Any and all material installed, or work performed in violation of above requirements will be
re-adjusted and corrected by the Installer without charge.

G. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the
electrical outlets, conduit and equipment, to determine the exact location of all outlets.

H. Label all equipment as herein specified.

I. After installation, equipment will be protected to prevent damage during the construction
period. Openings in conduits and boxes will be closed to prevent the entrance of foreign
materials.

J. Home runs indicated are not to be combined or reduced without written consent from the
Architect.

K. All connections to equipment will be made as required, if applicable, and in accordance with
the approved submittal and setting drawings.

L. Site Observation:
   1. Site observation visits will be performed randomly during the project by the Architect.
      Reports will be generated noting observations. Deficiencies noted on the site visit reports
      will be corrected. All work will comply with the Contract Documents, applicable Codes,
      regulations and local Authorities whether or not a particular deficiency has been noted in
      a site visit report.
   2. Be responsible to notify the Architect ten working days prior to closing in work behind
      walls, raised access floors, ceilings, etc., so that installed work can be observed prior to
      being concealed.
   3. Areas will stay accessible until deficiencies are corrected and accepted. Notify the
      Architect when all deficiencies are corrected. Return reports with items indicated as
      corrected prior to re-observation by the Architect.

M. Change Orders, Modifications, Revisions and Directives:
   1. When change orders, modifications, revisions or Architect's Directives are issued or
      authorized, provide the required additional material, equipment, personnel and workers to
      prevent delays in the work, and to complete the work within the time limit of the Contract
      unless a specific time extension is requested with the change and accepted. Include costs
      for expediting deliveries where required.
2. Requests for additional compensation will be submitted broken down and associated by item, tasks and Drawing or sketch number with material and labor costs, so quantities can be easily verified.

3. Requests will be properly and adequately identified so the scope of work can be clearly determined. Indicate who originated change in work.

4. Submit on all credits broken down as requested for adds. Credits will be separately identified and accounted for. Do not indicate as net changes with adds.

5. Unit costs for labor and material will be equal for adds, deletes and credits.

N. Loose materials will not be stored on-site. A "gang box" is acceptable to be placed in a location agreeable to the Owner and the General Contractor. The Installer is responsible for all equipment and materials and for their delivery until the system is deemed complete and accepted by the Owner.

O. A trailer may be used for the storage of materials to be located on the Owner's property at a location designated by the Owner and the General Contractor. Such on-site storage will be kept locked by the Installer. Security for the trailer and its contents will be strictly the responsibility of the Installer.

P. Protect existing spaces where work is being performed; protect it from damage and from the accumulation of dirt and debris.

Q. Any ceilings, walls, floors, furniture, equipment, furnishings, etc., damaged by the work of this Section will be replaced, or at the Owner's option, repaired with similar materials, workmanship and quality.

R. Work includes field survey of existing conditions, systems, equipment and tracing of existing circuits to determine scope of work.

S. Maintain the existing building in operation at all times during the entire construction period. If it is necessary to have a system shutdown, a written request for approval will be submitted in advance stating the estimated shutdown time. Work will be planned to minimize shutdown. Shutdowns will be at the convenience of the Owner and, if necessary, on premium time.

T. Clean and touch up all equipment, materials and work sites at the completion of work in each area.

U. Certain portions of the work area may be occupied during construction. Determine which areas and schedule work accordingly and include necessary premium time.

V. Make sure necessary provisions to provide continuous service of all existing systems throughout all occupied areas.

3.02 CABLE PATHWAYS

A. Install cables in pathways designed to support the cables per manufacturer instructions.

B. Provide all equipment and cabling for a complete installed operating system. Cable tray pathways, outlet boxes and grounding are provided by the Electrical Subcontractor unless otherwise noted.
C. All pathways provided under this Section will comply with fill capacities as per Code, TIA/EIA 569 and BICSI. Coordinate with electrical contractor prior to pathway installation to verify capacity.

D. Cable bending radius will not be less than minimum required by TIA/EIA and BICSI.

E. Cabling installed concealed will be supported from the building structure (e.g. cable trays, J-Hooks, etc.).

F. Cables will be installed no closer than 12 inches (305mm) to electrical equipment and wiring. When cables are required to cross power wiring, they will only do so perpendicular to the power wiring. Cable and power wiring will only cross each other the minimal number of times as required due to building design limitations.

G. Clearances: Clearances between cabling and other building systems as required by TIA/EIA 569 and BICSI will be maintained throughout the building.

H. All cables will be installed in a neat and workman-like manner. Cables will be installed parallel and perpendicular to building elements.

I. Provide expansion fittings and adequate cable slack at all building expansion joints.

J. Fire/smoke seal around all conduits, raceways, sleeves, slots, etc. where cables pass from one location to another.

3.03 FLOOR BOXES

A. Finish or close up all opening in floor boxes or poke throughs so that they maintain their fire ratings.

B. Refer to AV for box specs.

C. Coordinate with electrical contractor for conduit routing to TR prior to boxes installation.

3.04 WORK AREA OUTLETS

A. All work area outlet locations will be as indicated on the Drawings. Uniquely label each work area outlet and jack within the outlet according to the numbering convention outlined in the section on labeling.

B. Labeling shall be sequential in order, do not reuse a number throughout the entire infrastructure.

C. Work area outlets installed in casework will have their cables installed within the conduit or raceway provided.

D. Install jack and connector modules as indicated in the details and on the Drawings.

E. Work area outlets will be seated properly and will be installed level on walls and parallel to building elements as required.
3.05 INSTALLATION PRACTICES

A. Follow and adhere to installation practices specified by the applicable Telecommunications Industry Association standards.


E. Follow and adhere to installation practices specified by the Manufacturers.

F. Innerduct
   1. Provide innerduct in all conduits 2” and larger.
   2. Install Armored and non-armored fiber in fabric innerduct when placed in conduit.
   3. Armored fiber outside of conduit does not require innerduct.
   4. Install Non-armored fiber within rigid wall innerduct when outside of conduit, except within a telecommunications equipment room.
      a. Secure rigid wall innerduct to innerduct support so it does not slip or move during installation of cabling
      b. Transition from fabric to rigid innerduct, if it occurs, must be made so rigid innerduct is butted to fabric innerduct and secured to occur within conduit.
   5. Inner duct shall not be kinked or tightly bent in any way.

G. The general topology will be a "hierarchal star" configuration. All segments will originate in NRTL listed patch panels located in the telecommunication equipment racks/cabinets and end at the work area outlets.
   1. Routing:
      a. All cabling will be installed in conduit.
      b. Cables will be routed, in large groups, down main cable pathways, until a direct path to the point of access to the workstation outlet can be taken. At that point, cables will be routed, above all building systems, to the outlet location in accordance with standard installation practices, as described herein.
      c. Multiple cables to individual rooms will be pulled as a bundle and terminated at each end in sequential order so that labeling within a room location is in sequence.
      d. When not in conduit or tray, cables will be supported to the deck and/or beams, per Part 310 this specification. Hangers, clips, and other methods of grouping the cables and keeping them away from other systems installed in the building are to be provided and installed. Ensure that hangers and other methods of securing cable do not compress cable or damage insulation.
      e. Cables hanger will be attached to beams prior to fire proofing applications and with minimal disruption of the fireproofing. The Contractor will be responsible for restoring the fireproofing to appropriate levels. Restoration will be verified by the General Contractor. Provide documentation that installation or restoration of fire stop systems is acceptable to Owner and PM.
      f. Cable routes will be with 90-degree angles whenever possible, following building lines. Cables will not be installed randomly or diagonally through the building.
g. Cables installed partially or fully within the telecommunications room will be routed through and secured in the cable tray wherever possible. No cables are to be routed across the rooms at angles, or are the cables to be run from one portion of the room or tray to another. Cables placed in the cable tray are to be laced frequently to keep them neatly bundled and not permitted to shift from one side of the tray to the other as they are routed in the tray.

h. Station cables will be routed to fixed wall locations through EMT to back box. Secure and store four feet of slack cable above ceiling at cable entrance to EMT.

2. Separation from EMI Sources:
   a. Comply with BICSI TDMM and TIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
   b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment will be as follows:
   c. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   d. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   e. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
   f. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment will be as follows:
   g. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   h. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   i. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
   j. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures will be as follows:
   k. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   l. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
   m. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
   n. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
   o. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3. All cables will have both ends completely terminated at their respective patch panel and work area outlet. Individual conductors will be trimmed flush with IDC block.

4. The total length of permanently installed cable for any complete segment will not exceed 295 feet (90m). Do not splice or otherwise re-terminate any cable used, terminate only at the patch panels, cross connect blocks and work area outlets. Route cables [minimum of 12 inches (305mm) away] to avoid light ballasts, transformers, power wiring and other electrical devices so that there is no EMI or RFI interference with data transmission. Permanently label all cables six inches from the connector at each end, according to the numbering convention outlined in the section on labeling. All cables will be terminated at outlets, patch panels or cross-connect blocks ONLY.

5. Maximum pulling tension will not exceed 25 lbs./ft. when installing cables.
3.06 LABELING

A. Labeling procedure will meet EIA/TIA 568C, 606-B (Class 2 Administration) and BICSI Standards.

B. The labeling scheme will be provided as follows at all locations within the cable infrastructure:

C. Labeling will be as follows:
   1. Location identification will start from the left, as you walk in the doorway, and continue around the room in a clockwise direction.
   2. Data drops will be labeled with the room number and sequential letters; starting with 'A' (e.g. the first three data drops in Room 201 would be labeled 201A, 201B and 201C). Skip the letter 'V'.
   3. Voice drops will be labeled with the room number and the letter 'V' (e.g. the telephone drop in Room 128 would be 128V).
   4. Labeling shall be sequential in order, do not reuse a number throughout the entire infrastructure.
   5. Hand-written and embossed type labels are specifically prohibited. In addition, provide the following:
      a. Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.
      b. Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
      c. Inside receptacle box at the work area.
      d. Behind the communication room patch panel or punch block.
      e. Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications room location that is specific to the facilities terminated therein.
      f. Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606(A) standard color codes for termination blocks.
      g. Mount termination blocks on color-coded backboards.
      h. Labels will be machine-printed. Hand-lettered labels will not be acceptable.
      i. Use industry standard EIA/TIA and BICSI color codes as specified herein and maintain consistent color-coding throughout the building.

3.07 FIRE STOPPING

A. Work, in general, includes furnishing and installing fire and smoke barrier penetration sealing systems for openings in floor, walls, and other elements of construction.

B. Comply with requirements in Division 07 Section "Penetration Fire stopping”.

C. Comply with TIA/EIA-569-A, Annex A, "Fire stopping."

D. Comply with BICSI TDMM, "Fire stopping Systems" Article.

E. Applicator Qualifications: Two years of experience installing UL classified fire stopping.

F. Performance of materials will have been tested to provide fire rating equal to that of the construction.
G. Provide standard firestop details in shop drawings that are intended for use in this project for review and approval of relevant authority.

3.08 SHOP DRAWINGS:

A. Submit complete shop drawings coordinated where required with work of other sections.
   1. Shop drawings shall show layout, spacing, sizes, thicknesses, and types of fabrication, fastening and anchorage details, including welded connections and mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachments to other units or Work, and other details required for proper installation.

B. Submit shop drawings showing each condition requiring penetration seals indicating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.

C. Include details of cuts, connections, splices, bridging, accessories and other pertinent data required for a complete and proper installation.

D. Include items not shown and special components and installations not fully dimensioned or detailed in manufacturer’s product data.

E. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

F. Provide setting diagrams, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.

G. Submit a copy of UL illustration of each proposed system indicating Manufacturer approved modifications.

H. Manufacturer’s Data: Submit copies of Manufacturer’s specifications, recommendations, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.

I. Provide stamped drawings and structural calculations signed by a structural engineer registered in the State of installation. Provide calculations for loading and stresses of specially fabricated, designed framing. Clearly indicate all loads imposed on primary building structure.

J. Existing Project Conditions:
   1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
   2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

K. Materials:
   1. Provide materials classified by UL to provide for intended use. For Fire Barriers it must be equal to time rating of construction being penetrated.
   2. Provide asbestos free materials that comply with applicable codes and have been tested in accordance with UL 1479 or ASTM E-814.
L. Preparation: Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

M. Installation:
   1. Install penetration seal materials in accordance with printed instructions of the UL Building Materials Directory and in accordance with Manufacturer’s instructions.
   2. Seal holes or voids made by penetration to ensure an effective smoke barrier.
   3. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.
   4. Protect materials from damage on surfaces subject to traffic.

N. Field Quality Control:
   1. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
   2. Keep areas of work accessible until inspection by applicable code authorities.
   3. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.

O. Adjusting and Cleaning:
   1. Clean up spills of liquid components.
   2. Neatly cut and trim materials as required.
   3. Remove equipment, materials and debris, leaving area in undamaged clean condition.

P. Environmental Requirements:
   1. Furnish adequate ventilation if using solvent.
   2. Furnish forced air ventilation during installation if required by Manufacturer.
   3. Keep flammable materials away from sparks or flame.
   4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping materials.

3.09 SEALING OF PENETRATIONS AND OPENINGS

A. All fire stop systems will be installed in accordance with the Manufacturer’s recommendations and will be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

B. Where possible, utilize fire stop systems that have intumescent material built in as a part of the system.

C. Where systems with built in intumescent material are not provided, provide a seal around raceways or cables penetrating full height walls (slab to slab), floors or ventilation or air handling ducts so that the spread of fire or products of combustion will not be substantially increased, and that also maintains partition’s STC rating.

D. Penetrations through fire-resistant-rated walls, partitions, floors or ceilings will be fire stopped using approved systems and methods and NRTL listed products to maintain the fire resistance rating.
E. Installation restrictions of the listing agencies will be strictly adhered to {e.g. 24 inch (610 mm) minimum horizontal separation between boxes on opposite sides of the wall, maximum square inch opening in wall}.

F. Fire stopping in sleeves or in areas having small openings that may require the addition or modification of installed cables or raceways will be soft, pliable, non-hardening fire stop putty. Putty will be water resistant and intumescent.

G. Fire stopping in locations not likely to require frequent modification will be NRTL listed putty or caulk to meet the required fire resistance rating.

H. Box penetrations into a fire rated wall or shaft will have a fire-stopping pad installed on the back of the box.

I. Fire stopping of cable trays through walls will be with NRTL listed intumescent bricks to meet the required fire resistive rating and that will not allow products of combustion to pass through the protected opening. The NRTL listed bags will be installed inside and on both sides of the opening as required to meet the required resistive fire rating of the wall.

J. Fire stopping materials will be NRTL listed to UL 1479 (ASTM E814). Installation methods will conform to a UL fire stopping system. Submit specifications and installation drawings for the type of material to be used. Fire stopping materials will be as manufactured by 3M, International Protective Coatings Corp., Specified Technologies, Inc., Carborundum Company, RayChem, Nelson Fire Stop or approved equal.

3.10 WARRANTY REQUIREMENTS

A. Project Warranty
1. Equipment and materials required for installation under these specifications shall be the current model and new (less than one [1] year from date of manufacture), unused and without blemish or defect, and are to be guaranteed to be free from defect for a minimum of one year from date of project’s substantial completion.

2. When a defect or problem is observed within the first year after substantial completion, the Owner will notify the governing subcontractor through the proper channels. The appropriate Subcontractor then has 48 hours to fix the defect or furnish and install a replacement part/system, all at no cost to the project or Owner.

B. Advanced System Warranty for Telecommunications (Copper and Fiber Systems)
1. Beyond the initial one year project warranty, the Copper and Fiber Telecommunications Systems shall be warrantied for a minimum of 25 years by a national and reputable connectivity or cabling manufacturer.
   a. This warranty shall to cover any material defect, as well as the performance of the cabling system. (Example: A Category 5e cabling system is to deliver 1000BASE-T speed, or 1 “Gig” performance for the entire length of the warranty period.)
   b. This warranty shall cover both material and labor for the full length of the warranty period.

2. Submit copies of written warranty, minimum of one year, agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion residence, weather resistance, extrusion residence, migration residence, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted
Manufacturer’s data as an inherent quality of the material for the exposure indicated. The guarantee period will be one year from date of substantial completion.

a. The Telecommunications Subcontract shall be certified by this manufacturer.
b. The following manufacturers are conditionally approved to provide the system warranties (subject to specific project requirements):

1) Copper Connectivity Manufacturers
   a) Systimax
   b) Approved alternate

2) Fiber Connectivity Manufacturers
   a) Systimax
   b) Approved alternate

3) Cabling Manufacturers
   a) Systimax
   b) Approved alternate

3.11 CABLE SUPPORTS

A. Provide hook and loop (Velcro) cable wraps at all panels, equipment racks, cabinets and J-hook supports. Tie wraps are specifically prohibited.

B. For horizontal cables, secure with minimum required compression in order to secure the cables properly without impeding the signal transmission rating (geometry) of the cable. Hook and loop (Velcro) cable wraps may be used in lieu of cable ties for copper cables only.

C. Provide J-Hook supports from the building structure as required for cable runs to the cable drop location. Maximum distance between supports will be from 3.5 to 5.5 feet (with spacing randomly determined) depending on the structural elements of the building.
   1. Comply with maximum number of cables per support specified by manufacturer.
   2. Provide additional supports as required when cable quantities exceed manufacturer’s data, and to maintain required bending radius of cables.
   3. Cables installed exposed or in areas subject to abuse {below 10 feet (3m) above finished floor} or in accessible areas will be installed in conduit.
   4. All J-Hooks supported by drop wire must be stabilized at the lower end to a fixture such as T-Bar grid. The T-Bar attachment is not meant for ceiling support. It may not be used for that purpose, but only to stabilize the hangar per NEC 300.11.

D. All cables will be supported directly from building structure. Under no circumstance will cable be installed using cross bracing, plumbing/sprinkler pipes, ceiling systems or any other system that is not a specifically approved method to independently support cables. Cables will not be allowed to rest on ceiling tiles, duct work, piping, etc. Supports will be provided as required in order for cables to avoid contact with any other building system. Bundle cables in groups by Room.

3.12 CABLE PROTECTION

A. Provide bushings in all metal studs and the like where cables will pass through. Bushings will be of two (2)-piece construction with one piece inserted through the opening and the second piece locking it into place. Single piece bushings with locking tabs or friction fit are specifically prohibited.
B. Cables to be installed in existing enclosed open bays or furred spaces where conduit stubs are not provided, will be protected from chafing or any damage. The Installer will verify that the warranty will not be violated before installing any cabling in these locations.

C. Provide cutting, coring, sleeves and bushings and seal as required at all penetrations.

D. Cables damaged during installation will not be repaired. They will be completely replaced with new cable at no cost to the Owner.

3.13 GROUNDING & BONDING

A. Refer to section 27 05 26 for Grounding and Bonding requirements. Work under section 27 05 26 is not anticipated, however; it should be verified in-field that the existing telecommunications infrastructure is properly grounded and bonded per the instructions and standards within this specification section.

3.14 DOCUMENTATION

A. Label all equipment as herein specified.

B. Provide:
   2. Hard copy documentation of test results for every cable segment and link in 3-ring binder. Documents will include measured values as well as whether or not the test passed.
   3. "Record" drawings indicating location of all equipment including but not limited to work area outlets, patch panels, cross connect blocks, on each segment and cable routing. Indicate labeling for each piece of equipment.
   4. Record drawings indicating actual cable routes and outlet identifiers. Provide respective copies mounted in each telecommunications room, and the main cross connect.

C. Provide "as-built" Drawings on AutoCAD Version 12 or higher to the Owner. Obtain copy of original Drawings from the Architect.

D. Submit NRTL certification that the structured cabling system meets the transmission requirements of TIA-568-C.0.

3.15 TRAINING

A. The appropriate Telecommunications Subcontractor shall be responsible for training of facility personnel in accordance with requirements of this Section and Division.

B. Training shall take place within 2 weeks after substantial completion and shall include programs for on-site operations and maintenance of telecommunications and audio/video systems. Training shall be for not more than ten people, shall be held at the Owner's site, and shall be of sufficient duration and depth to ensure that the trained personnel can operate the installed systems and can perform usual and customary maintenance actions.

C. As a minimum training sessions will consist of the following:
   1. General project information and review will be by the General Foreman or Superintendent of the Trade.
2. Specific system training will be by a Factory Trained Representative.
3. Provide a complete review of the project and systems including, but not limited to, the following:
   a. Review each As-Built Drawing (use of ‘typicals’ is acceptable).
   b. Note equipment layouts, locations and control points.
   c. Review each system.
   d. Review system design operation and philosophy.
   e. Review areas served by equipment.
   f. Identify color codes used.
   g. Review features and special functions.
   h. Review maintenance requirements.
   i. Review operation and maintenance manuals.
   j. Respond to questions (record questions and answers).
4. After training, walk the entire project, review each equipment room and typical locations. Explain equipment and proper operation.

D. During the instruction period the Owner and Maintenance Manual will be used and explained.

E. The Owner and Maintenance Manual material will be bound in 3-ring binders and indexed. On the edge of the binder provide a clear see-through plastic holder with a typed card indicating the Project name, the Architect's name, the installer's name and the Volume number (e.g., Vol. No.1 of 2).

F. Provide name, address and telephone number of the Manufacturer’s representative and Service Company for all items supplied so that the source of replacement parts and service can be readily obtained.
   1. Include copies of Manufacturer’s and installer's warranties and maintenance contracts and performance bonds properly executed and signed by an authorized representative.
   2. Include copies of all test reports and certifications.

3.16 CLEANING

A. In all telecom room spaces - a thorough sweeping, vacuuming and wet mopping shall be performed on a weekly basis or more frequently as directed by the owner. Cleaning shall include floors, rafters, floor joists, exposed structural members, exposed mechanical/electrical equipment and ductwork/piping/conduits, walls, ladder trays, tops of cabinets/racks, existing/new passive and active components, or per manufacturer recommendations.

B. All cable managers and snap covers shall be wiped clean, both inside and outside of front, including rear channels. All clear covers and doors shall be cleaned, both front and rear per manufacturer recommendations.

C. Inside of fiber optic enclosure and patch panels shall be blown clean of settled dust. Cleaning shall be performed for all new construction projects or where gypsum sanding has been performed.

D. NOTE: During installation and prior to final handoff to Owner, keep all open fiber and copper ports covered utilizing plastic or tape that leaves no sticky residual.

E. All scraps, boxes, spools, pull-line and trash shall be removed and properly disposed of.
F. All residual cable lubricant shall be cleaned from floors and walls with an appropriate degreaser.

3.17 PROJECT CLOSEOUT

A. Provide close out submittals as required herein and include the following close out submittals.
   1. Operation and Maintenance Manuals
   2. Record Drawings
   3. Test Reports
   4. Warranty certification from Manufacturer’s
   5. Extra Materials
   6. Provide factory calibration report of field test equipment

B. Obtain written receipts of acceptance close out submittals submitted. Receipts will specifically detail what is being delivered (description, quantity and specification section) and will be dated and signed by firm delivering materials and by the Owner's Representative.

C. Provide As-Built drawings indicating actual cable routing and cable terminations including all required identifiers.

D. Provide a half size laminated set of drawings mounted in the Main Equipment Room.

E. All sketches, drawings, and charts herein are for the purpose of providing for specifications in a simplified format. Errors and omissions in such do not relieve the Contractor of the responsibility for providing a fully complete, secure and properly operating structured cabling system suitable for the intended use. Bidders must obtain a complete set of Project Drawings and Specifications to determine the full scope of work. In case of conflict, the Project Drawings and Specifications will prevail.

END OF SECTION
SECTION 27 05 26

COMMUNICATIONS GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This section governs the products and execution requirements relating to furnishing and installing grounding and bonding for the communication systems, and supplements requirements found in related sections.

B. Specifications and drawing package in its entirety, conditions set forth in base contract, exhibits, etc. as the items pertain to this project.

C. Description of work:
   1. Grounding and Bonding of the existing telecommunications system including horizontal cabling pathways is complete. The scope of work includes verifying that the telecommunications infrastructure is properly bonded and grounded per the following specifications and industry standards.
      a. Coordinate with electrical contractor including:
         1) Pathways, termination points, buss bar locations, and connections to the main electrical service ground and electrical distribution panels, conduit, fittings and bodies; bonding, Grounding cable and fittings; junction boxes; pull boxes; gutters; and measured pull tape.

D. Related Sections:
   1. 270000: Communications
   2. 270820: Copper Testing
   3. 271500: Communications Horizontal Cabling
   4. 271600: Communications Connecting Cords Devices & Adapters

1.2 ADDITIONAL INFORMATION

A. Refer to Section 27 00 00 for Part 1 General information

1.3 RELATED DOCUMENTS

A. The most recent versions of all related documents apply to this project.

B. Comply with the following codes and standards:
   3. IEEE 1100 – 2005 - (Emerald Book) - Recommended Practice for Powering and Grounding Electronic Equipment

C. The following guidelines shall be followed:
   1. BICSI, Telecommunications Distribution Methods Manual (TDMM)
   2. BICSI, Information Transport Systems Installation Methods Manual (ITSIMM)
   3. The following related project specifications shall be followed:
   4. Specification 27 00 00 Communications

D. References:
   1. American National Standards Institute (ANSI):
      a. C80.1 Rigid Steel Conduit – Zinc Coated.
      b. C80.4 Fittings for Rigid Metal Conduit.

E. Federal Specifications (FS):
   1. W-C-58C Conduit Outlet Boxes, Bodies Aluminum and Malleable Iron.
   3. WW-C-566C Flexible Metal Conduit.
   4. WW-C-581D Coatings on Steel Conduit.

F. National Electrical Manufacturers Association (NEMA):
   1. RN1 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Electrical metallic Tubing.
   2. TC2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
   3. TC3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
   4. NEMA VE 1 – Metal Cable Tray Systems.
   5. NEMA VE 2 – Metal Cable Tray Installation Guidelines.

   2. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Gal annealed) by the Hot-Dip Process.

H. Underwriters Laboratories Inc. (UL):
   1. 6 Rigid Metal Electrical Conduit.
   2. 514 B Fittings for Conduit and Outlet Boxes.
   3. 651 Schedule 40 and 80 Rigid PVC Conduit.
   4. 651A Type EB and A Rigid PVC Conduit and HDPE Conduit.
   5. 1666 Standard for Riser Application for Optical Fiber Raceway.

I. Local, county, state and federal regulations and codes in effect as of date of purchase.

J. Equipment of foreign manufacture must meet U.S. Codes and standards. It will be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.
1.4 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

A. The publications listed herein form a part of this specification. The publications are referred to in the text by basic designation only.

B. Specific reference in specifications to codes, rules, regulations, standards, manufacturer’s instructions, or requirements of regulatory agencies will mean the latest printed edition of each in effect at the date of contract unless the document is shown dated.

C. Conflicts:
   1. Between referenced requirements and contract documents: Comply with the one establishing the more stringent requirements or greater quantity as per context of the document.

1.5 SUBMITTALS

A. The Contractor will perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective submittal has been approved by the Owner. Such work will be in accordance with approved submittals.

B. Qualifications: The Contractor will submit qualification data sheets for firms and persons as specified in the “Quality Assurance” article of this specification to demonstrate their capabilities and experience.

C. Proposed product data sheets: The Contractor will submit catalog cut-sheets that include manufacturer, trade name, and complete model number for each product specified. Model number will be handwritten and/or highlighted to indicate exact selection. Identify applicable specification section reference for each product.

D. The following submittals are due at the Pre-Construction Phase, in accordance with submittal requirements in Section 27 00 00 Communications:
   1. Product Information
      a. Provide manufacturer’s product information cut-sheet or specifications sheet with the specific product number identified.
   2. Shop Drawings
   3. Provide scaled drawings (floor plans not less than 1/16” = 1′-0”) indicating the location and size, dimensions, type of connection (e.g., mechanical, exothermic weld of each bonding buss bar (e.g., TMGB, TGB), conductor (e.g., BCT, GE, TBB), connections (e.g., lugs), and splice points.
   4. Provide scaled plan and elevation drawings of telecommunications rooms (not less than 1/4” = 1′-0”) indicating locations of buss bar (e.g., TMGB, TGB, UBC, RGB).
   5. Bonding and Grounding shall have its own separate drawing(s).

E. The following submittals are due Post-Construction, in accordance with the submittal requirements in Section 27 00 00 Communications:
   1. As-Built Drawings
   2. Furnish CAD drawings of completed work including cable ID numbers following the Owner’s labeling standards. Submit in hardcopy (two full size and two half size) and electronic formats:
a. Provide scaled drawings (floor plans not less than 1/16” = 1’-0”) indicating actual location and size/length of TMGB, TGBs, BCT, GE and TBB conductors and all splice points.
b. Provide scaled plan and elevation drawings of telecommunications rooms (not less than 1/4” = 1’-0”) indicating actual locations of TMGB and TGBs.
c. Bonding and Grounding shall have its own separate drawing(s).
3. Manufacturer and Maintenance Manuals for all installed equipment. This is to include:
a. Manufacturer specification sheets (cut sheets) and installation instructions/manuals for all installed products.
4. A letter from the contractor Project RCDD stating that the grounding system has been installed in accordance with the project documents and the referenced codes, standards, and guidelines. This letter is to also specifically acknowledge that the telecommunications grounding system has been fully tested according to these specifications. The required contents of this letter may be incorporated into the letter required from the Project RCDD in section 27 00 00.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. The Electrical Contractor shall furnish and install telecommunications grounding buss bar, telecommunications bonding backbone(s), grounding equalizer(s), and equipment bonding conductors to install a complete telecommunications grounding system.

B. Field coordinate installation of conduit and cable with other trades to ensure clearance requirements are met.

C. Coordinate with all contractors providing equipment outside the scope of this contract.

PART 2 - PRODUCTS

2.1 GENERAL

A. All components shall be listed by a NRTL.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work are included in each product type, but are not limited to those listed.
2.2 TELECOMMUNICATIONS MAIN GROUNDING BUSS BAR (TMGB)

A. Provide a telecommunications main grounding buss bar (TMGB) at the telecommunications service entrance (or as indicated on the drawings).

B. The TMGB shall be located within each building entrance point (BDF) or main telecommunications equipment room.

C. The TMGB shall:
   1. Be a predrilled copper buss bar with holes for use with correctly matched Listed lugs and hardware.
   2. Have minimum dimensions of 0.25” thick by 4” wide by 20” long. Increase length as necessary to provide all connections plus 25% spare capacity.
   3. Be listed by a NRTL.
   4. Be manufactured by:
      a. Chatsworth P/N 40153-020
      b. Or approved alternate

2.3 TELECOMMUNICATIONS GROUNDING BUSS BAR (TGB)

A. Provide a telecommunications grounding buss bar (TGB) in each telecommunications room.

B. The TGB shall:
   1. Be a predrilled copper buss bar with holes for use with correctly matched listed lugs and hardware.
   2. Have minimum dimensions of 0.25” thick by 4” wide by 10” or 12” long. Increase length as necessary to provide all connections plus 25% spare capacity.
   3. Be listed by a NRTL.
   4. Be manufactured by:
      a. Chatsworth P/N 40153-012
      b. Or approved alternate

2.4 BONDING CONDUCTOR FOR TELECOMMUNICATIONS (BCT)

A. BCT shall:
   1. Be copper must be insulated with green insulation
   2. Be Listed for the application when insulated.
   3. As a minimum, the same size as the largest TBB.

B. The manufacturer shall be:
   1. Harger
   2. Or approved equivalent

2.5 TELECOMMUNICATIONS BONDING BACK BONE (TBB)

A. The TBB shall:
   1. Be copper and may be insulated.
   2. Be Listed for the application when insulated.
   3. Be sized at 3 kcmil per linear foot of conductor length up to a maximum size of 750 kcmil.
2.6 **RACK BONDING CONDUCTOR (RBC)**

A. An RBC shall:
   1. Be copper and may be insulated.
   2. Be Listed for the application when insulated.
   3. Be sized as a No. 6 AWG.

B. The manufacturer shall be:
   1. Harger
   2. Or approved equivalent

2.7 **RACK GROUNDING BUSS BAR (RGB)**

A. Description: grounding Strip for 2-post and 4-post Communications Racks.

B. A RGB shall:
   1. Be wrought copper and tin plated.
   2. Be capable of supporting multiple unit bonding conductors.

C. The manufacturer shall be:
   1. Harger
   2. Panduit, Grounding Strip Kit, RGS134-1Y
   3. Or approved equivalent

2.8 **GENERAL BONDING CONDUCTORS OR JUMPERS**

A. Provide and install general bonding conductors and jumpers per construction documents. Refer to drawings and execution section for required locations.

B. For all conductors and jumpers connecting equipment located in the same room as the TMGB/TGB, conductors/jumpers shall be in a green insulated jacket. This jacket shall include markings that indicate conductor size (minimum of #6 AWG), manufacturer and UL listing.

C. Manufacturer shall be:
   1. Harger
   2. Panduit
   3. Or approved equivalent

2.9 **BONDING ACCESSORIES**

A. Grounding Lugs
   1. Shall be Listed for the application.
   2. Shall be two holes compression crimp with inspection window, unless otherwise noted.
   3. Copper or tin plated copper.
   4. Manufacturers shall be:
      a. Erico, Cadweld Telecom Lugs
      b. Harger
      c. Framatome Connectors/Burndy Electrical.
      d. Panduit
      e. Or approved equivalent
B. Unit Bonding Conductor (UBC)
   1. Shall be Listed for the application.
   2. Shall be a minimum No. 12 AWG
   3. Copper with 90-degree bent lugs installed.
   4. Manufacturers shall be:
      a. Erico, Cadweld Telecom Lugs
      b. Harger
      c. Panduit
      d. Or approved equivalent

2.10 MATERIALS

A. All conduits, fittings, junction and pull boxes will be UL rated.

B. All conduits, fittings, junction and pull boxes will comply with the NEC.

C. PVC-Coated Rigid Steel Conduit and Fittings: Follow NEMA RN1 (Type A).

D. Non-metallic Conduit and Fittings: Pass NEMA TC2, UL 651 and 651A and FS W-C-1094A.
   EMT fittings will be formed steel compression ring type. Die cast fittings are not allowed.

E. Rigid Steel Galvanized Conduit and Fittings Before Coating
   1. Follow FS WW-C-581d, ANSI C80.1, and UL 6.
   2. Pass bending, ductility, and thickness of zinc coating in ANSI C80.1.

F. Electrical Metallic Tubing (EMT):
   1. EMT fittings will be formed steel compression ring type. Die cast fittings are not allowed.
   2. EMT will be UL listed and conform to NEC Article 300.22.
   3. Will be used inside buildings only.
   4. Only manufacturer’s fittings, transition adapters, terminators and fixed bends will be used.
   5. All transition junction and pull boxes, fittings terminators and adapters will be a metallic material.
   6. Minimum average tensile strength will be 1250 lbs. For 1½-inch and smaller conduits and inner duct.
   7. Minimum average tensile strength will be 1800 lbs. For conduits larger than 1½ inch.

G. Conduit Bodies: Follow UL 514B and FS W-C-58C. Furnish sufficient coating for touch up after installation.

H. Conduit Fittings
   1. All fittings will be compression or threaded.
   2. Fittings will provide a secure connection for pulling communications cables.
   3. Setscrew fittings are not permitted.

I. Conduit “condulets” are not permitted. Smart LB’s are permitted.

J. Flexible conduit is not permitted.

K. Non-metallic conduits are not permitted in above ground installations. Conversion fittings are required for non-metallic (below ground) to metallic (above ground) transitions.
L. Buss bars:
   1. Electrotin-plated for reduced contract resistance

M. Telecommunications Bonding Backbone (TBB)
   1. All Telecommunications Bonding Backbone (TBB) Cables will be insulated and installed in conduit between manholes, telecommunications closets, building steel frame and building electrical grounding system.
   2. TBB cables will interconnect all Telecommunications Grounding Buss bar (TGB) with the Telecommunications Main Grounding Buss bar (TMGB). The TBB will originate at the TMGB and extend throughout the building and connects to all the TGB’s in telecommunications closets and equipment rooms.
   3. The TBB will be installed without splices, where practicable
   4. Joined segments (conductors to buss bars) will be connected using irreversible connectors such as exothermic welding or equivalent.
   5. The TBB will be sized per table below. The TBB from TGB to the panel board in the same telecommunications space will be No. 6 AWG. All TBB connections to the TGB will utilize exothermic weld connectors.
   6. Approved bonding (Exothermic welds or double lug crimp) will be used to connect TBB from TMGB or TGB and building steel frame. All other connections will use 2-hole compression connectors.
   7. UL Listed with Flame Propagation compliant with UL 2024.

N. Antioxidant Joint Compound for use with copper to copper bonding
   1. Approved manufacturer: Harger P/N HCAJC8

O. Pull Boxes, Junction Boxes and Gutters
   1. All junction boxes, gutters and pull boxes will comply with NEC Article 314.
   2. All junction boxes, gutters and pull boxes will meet the following minimum material requirements:
      a. 16-gauge steel or heavier.
      b. Seams will be continuously welded and ground smooth.
      c. External screws and clamps.
      d. External mounting feet (where possible).
      e. Oil-resistant gasket and adhesive.
      f. ANSI 61 gray polyester powder coating inside and out over phosphatized surface.
      g. UL 50 type 12.
   3. All junction boxes, gutters and pull boxes will be provided with bushings for conduits and/or cabling.
   4. All junction boxes, gutters and pull boxes will be securely installed.
   5. All junction boxes, gutters and pull box sizes for single and multiple conduit runs will comply with BICSI TDMM.
   6. All bonding conductors and connectors will be listed for the purpose intended and approved by a Nationally Recognized Testing Laboratory (NRTL).
   7. All bonding conductors will be insulated and copper. The minimum bonding conductor size will be a No. 6 AWG.
PART 3 - EXECUTION

3.1 GENERAL

A. Locate TMGB and TGBs so that they are permanently accessible to telecommunications personnel.

B. At a minimum, follow all manufacturer instructions. In case of discrepancy between manufacturer and contractor requirements, the more stringent shall apply. In the case of conflicting instructions, report any discrepancy to the Design Engineer in a timely fashion so as not to impact the construction timeline.

C. At a minimum, provide exothermic welds as identified on the drawings or required in the specifications. For all other connections, irreversible compression connections are sufficient.

D. Identification
   1. All telecommunications grounding and bonding conductors shall be labeled within 6” of each end. Labels shall be nonmetallic and read as follows:

   IF THIS CONNECTOR OR CABLE IS FOUND TO BE LOOSE OR MUST BE RECONFIGURED OR REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER PRIOR TO ANY FURTHER WORK

E. Testing
   1. All grounding connections shall be tested for continuity and resistance after installation but prior to substantial completion. Refer to drawings for grounding riser and test measures. The telecommunications contractor is to invite the Design Engineer and ITS representative to witness a portion of this testing while it is being performed.
   2. The test performed shall use an earth ground resistance tester that is configured for a continuity test otherwise known as a two-point test or a “dead earth” test. Tests shall be conducted between the electrical entrance ground and the TMGB as well as at each TGB. This resistance shall be less than 0.05Ohms.
   3. Coordinate with the electrical installer for the test of the Building’s Grounding Electrode System and its resistance at earth. It is recommended that this resistance measure be equal to or less than 5 ohms. Include in the grounding test report the measured resistance at the Building’s Grounding Electrode System as reported by the entity performing the test.

3.2 TMGB

A. All metallic raceways for telecommunications cabling located within the same room or space as the TMGB shall be bonded to the TMGB.

B. Insulate the TMGB 2” from the wall.
C. For outside plant cables entering a building with a cable shield isolation gap, bond the cable shield (on the building side of the gap) to the TMGB. Outside plant protectors shall be bonded to the TMGB with a No. 6 AWG conductor.

D. Connections to the buss bar shall be made with 2-hole lugs.

E. Connections shall be made by cleaning the area of connection on the buss bar and on the two-hole lug and then applying a thin coating of anti-oxidant compound.

3.3 TGB

A. All metallic raceways for telecommunications cabling located within the same room or space as the TGB shall be bonded to the TGB.

B. Insulate the TGB 2” from the wall.

C. Connections to the buss bar shall be made with 2-hole lugs.

D. Connections shall be made by cleaning the area of connection on the buss bar and on the two-hole lug and then applying a thin coating of anti-oxidant compound.

3.4 BCT

A. Route BCT in conduit from telecommunications service entrance room to the main electrical service ground connection.

1. Label conduit at telecommunications service entrance with tag or adhesive label that states “Building Conductor for Telecommunications (BCT) to Main Electrical Service Ground Connection”.

2. Label conduit at main electrical service ground connection with tag or adhesive label that states “Building Conductor for Telecommunications (BCT) to Telecommunications Main Grounding Buss bar (TMGB)”.

3. BCT shall not be run in a metallic conduit and shall not be completely encircled by metallic clamps.

3.5 TBB

A. Where following the same routing as cable tray, attach TBB on the outer side of the cable tray to minimize contact with communications cabling.

B. Size the grounding conductors according to the following table, except as it varies in the grounding riser diagram:

<table>
<thead>
<tr>
<th>TBB Length in Linear meters (feet)</th>
<th>TBB Size AWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 4 (13)</td>
<td>6 (16mm²)</td>
</tr>
<tr>
<td>4-6 (14-20) 4</td>
<td>4 (25mm²)</td>
</tr>
<tr>
<td>6-8 (21-26)</td>
<td>3 (25mm²)</td>
</tr>
<tr>
<td>8-10 (27-33)</td>
<td>2 (35mm²)</td>
</tr>
<tr>
<td>10-13 (34-41)</td>
<td>1 (35mm²)</td>
</tr>
<tr>
<td>13-16 (42-52)</td>
<td>1/0 (50mm²)</td>
</tr>
<tr>
<td>16-20 (53-66)</td>
<td>2/0 (70mm²)</td>
</tr>
</tbody>
</table>
3.6 GENERAL BONDING CONDUCTORS OR JUMPERS

A. General bonding conductors or jumpers are to be utilized in each telecommunications room between the TMGB/TGB and the following components:
   1. The communications building entrance protectors.
   2. Electrical panel board (if in same room as TMGB/TGB).
   3. Building steel (if available in same room as TMGB/TGB).
   4. Telecommunications ladder rack and cable tray.
      a. Bonding jumpers are to be utilized to ground adjacent pieces of ladder rack and cable tray together, reducing the need to a single conductor back to the TMGB/TGB.
      b. In cases where ladder rack or cable tray is painted, prepare each section by removing paint at the connection point to ensure a completely bonded connection. If the contractor believes this is not necessary, submit documentation from manufacturer indicating NRTL testing was done in regards to grounding without removal of the paint.
   5. Telecommunications equipment racks and cabinets.
      a. Each cabinet and rack shall be bonded to the TMGB/TGB by bonding to the row’s bonding conductor with a #6 AWG RBC from the Rack Grounding Buss bar (RGB). All conductors are to be of equal length and bonded with non-reversible bonds.
      b. In cases where racks or cabinets are painted, prepare each item by removing paint at the connection point to ensure a completely bonded connection. If the contractor believes this is not necessary, submit documentation from manufacturer indicating NRTL testing was done in regards to grounding without removal of the paint.
      c. Bond adjacent racks and cabinets in an approved manner with #6 AWG insulated green conductor.
      d. Telecommunications Equipment Bonding Conductor (TEBC) bonds components within a rack or cabinet. Install a minimum of #12 AWG insulated green conductor.

B. Row bonding conductor
   1. Install the rack or cabinet row bonding conductor sized as indicated on bonding riser and bonding detail.
   2. The default size for row bonding conductors is #2/0 AWG.

3.7 GROUNDING LUGS

A. Wires shall be inserted to the full depth of the lug.

B. Space between wire insulation and the body of the compression lug shall be kept to a maximum of 1/4 inch.

C. Lug must agree with wire size.
D. To assure proper die is used with the specified connector, manufacturer's embossed coding systems shall be adhered to.

E. Connectors shall not be modified in any way.

F. Daisy chaining and stacking (piggy backing) of ground lugs is prohibited.

G. Bolts, nuts, washers used to secure ground connections shall match the diameter of the hole.

3.8 PREPARATION

A. Contractor’s on-site RCDD supervisor will review, approve and stamp all shop drawings, coordination drawings and record drawings.

B. Verify conduit system is properly sized for cables (minimum one inch, unless otherwise noted in Drawings).

C. Verify general conduit route following Drawings.

D. Verify substrates to which work is connected and determine detail requirements for proper support.

E. Verify proper location and type of rough-in for conduit, cable terminations and ground buss bar.

3.9 INSTALLATION

A. Coordinate locations with other trades prior to installation.

B. Install work following drawings, manufacturer’s instructions and approved submittal data.

C. Installation plans and requests for information (RFIs) will be reviewed by contractor’s on-site RCDD.

D. All work will be supervised and reviewed by contractor’s on-site RCDD.

E. Check all bonds for loose connections in walk-thru prior to testing system.

F. Test bonding of system for all metallic components back to buss bar for conformance to a 0.01 ohms maximum resistance.

G. Locations and Types:
   1. Install PVC coated conduits in outdoor above-ground locations, inside valve vaults and wet wells, and in corrosive and wet environments.
   2. Install PVC conduits in buried duct banks or encased in concrete. Use PVC coated rigid steel for footing, slab, or other stub-outs.
   3. Install exposed conduit parallel or perpendicular to lines of existing construction and grouped together where possible, without interfering with use of premises or working areas. Prevent safety hazards and interference with operating and maintenance procedures.
   4. Conduit may pass through areas with temperature differential of 20 degrees F or more. Seal with proper fitting at barrier between areas of differing temperature.
5. Do not install conduit in interference with equipment placement or operation; piping; structural members; maintenance access; indicated future equipment.
6. Contractor’s RCDD supervisor will coordinate with drawings of other disciplines to determine availability of space for installation.

H. Design Considerations
1. Conduit fill will comply with ANSI/TIA/EIA-569-C.
2. The minimum bend radius is ten (10) times the conduit outside diameter (OD) for conduits 2” and greater.
3. Below grade conduit will extend four inches above finished floor (AFF) with a bushing.
4. Ceiling conduit or sleeves will extend six inches below finished ceiling with a bushing.
5. All stubbed conduit ends will be provided with a ground bushing.
6. All conduit penetrations will comply with all applicable fire codes. All conduit penetrations in fire-rated walls or floors will be sealed and fire proofed to at least the rating of the penetration area.
7. Conduits will be routed in the most direct route, with the fewest number of bends possible.
8. There will be no continuous conduit sections longer than 100 feet. For runs that total more than 100 feet, insert junction or pull boxes (or gutters if appropriate) so that no continuous run between pull boxes is greater than 100 feet.
9. There will be no more than two 90-degree bends (180 degrees total) between conduit pull boxes.
10. Changes in direction will be accomplished with sweeping bends observing minimum bend radius requirements above. Do not use pull boxes for direction changes unless specifically designated otherwise in the Drawings.
11. Unless otherwise noted in the Drawings, conduits entering pull boxes will be aligned with exiting conduits.

I. Telecommunication Bonding Backbone (TBB) Installation
2. TBB placed in ferrous metallic conduit that exceeds 1m(3 ft.) in length, will be bonded to each end of the conduit with a conductor sized as a NO. 6AWG, minimum.
3. The TBB conductor for telecommunications will bond the TMGB to the service equipment (power) ground.

J. Antioxidant Joint Compound for use with copper to copper bonding
1. Utilize for copper to copper connections, copper threads and all grounding/bonding applications

K. Identification: Refer to Section 27 00 00 for labeling requirements.

3.10 ACCEPTANCE

A. Once all work has been completed, test documentation has been submitted and approved, and the Owner is satisfied that all work has been completed in accordance with contract documents, the Owner will notify Contractor in writing of formal acceptance of the system.

B. Acceptance will be subject to completion of all work and submittal and approval of complete as-built documentation as described above, and MAA final inspection of the work for compliance with the approved as-built documentation.
END OF SECTION
SECTION 27 05 43
UNDERGROUND DUCTS AND UTILITY STRUCTURES

PART 1 – GENERAL

1.1 SUMMARY
A. This Section covers the construction and emplacement of buried duct banks and manholes as site infrastructure. It does not cover the pulling of wire or cables into the finished ductbank or manhole. The following items and accessory materials are addressed:
   1. Ducts in direct-buried duct banks.
   2. Ducts in concrete-encased duct banks.
   3. Manholes and manhole accessories.
B. Related Sections include the following:
   1. Section 01330, Submittal Procedures
   2. Section 02200, Earthwork
   3. Section 03300, Cast-In-Place Concrete

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall be new and applicable as listed, labeled, or approved by the Underwriters' Laboratories, Inc. Defective equipment or equipment damaged in the course of installation or test shall be replaced or repaired in an approved manner.

2.2 CONDUIT AND DUCT SYSTEMS - GENERAL
A. Conduit and duct systems shall be of the type specified in the drawings and shall meet the requirements herein.

B. Conduits shall be joined in such a way as to prevent solid matter from entering the joints. Joints shall form a continuous smooth interior surface between joining conduit sections so that cable will not be damaged when pulled past the joint.

C. Conduit installed on bridges, building roofs, or high-temperature areas shall incorporate expansion joints. Metallic conduit on a bridge shall be grounded.

D. Pull boxes shall be "FL" style box assemblies of Fibrelyte® composite materials as manufactured by Christy Concrete products or approved equal, unless otherwise noted on drawings. Material compressive strength shall not be less than 11,000 psi. Covers shall be bolted-down using penta-head bolts, heavy duty to meet AASHTO H20 traffic load and logo as indicated. Boxes shall be stackable for extra depth. Dimensions of pull boxes shall be as specified on drawings.

E. Communication conduit for fiber optic cable shall have high capacity flexible multiple channel inner duct manufactured by FO-DUCT or as specified on contract drawings. The number of channels shall be specified on the contract drawings.
2.3 METALLIC CONDUIT - GENERAL
A. All steel conduits, RGS or IMC, in direct contact with the earth shall receive a corrosion protective covering that is mechanically applied in a factory or field plant especially equipped for this purpose, or as herein specified.

2.4 RIGID METAL CONDUIT AND FITTINGS
A. Rigid steel conduit: ANSI C80.1.
B. PVC externally coated conduit: NEMA RN 1; rigid steel conduit with external 20-mil PVC coating and internal galvanized surface.
C. Fittings and conduit bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.

2.5 NON-METALLIC CONDUIT - CONCRETE ENCASED
A. Conduit: NEMA TC 2; Schedule 40 PVC or Schedule 80 PVC as indicated on the drawings.
B. Fittings and conduit bodies: NEMA TC 3.
C. The concrete for the duct bank envelope shall conform in quality to all requirements for placing and curing as described in Section 03300. Concrete shall not be emplaced until inspection of the completed ducts is obtained from the SCO.
D. Soil backfilling of the excavation shall not occur until the concrete has set for 5 hours. Conduit shall be not covered with backfill until the installation approval is obtained from the SCO.
E. For vertical stub-ups, horizontal bends, and any off-sets greater than 22° in primary electrical and communication underground conduit runs, use PVC-coated rigid steel or IMC factory bends. For electrical conduits, the minimum radius shall be 24 inches for 3 inches and smaller conduit and 36 inches radius for conduit larger than 3 inches, unless noted otherwise on the drawings. For communication conduits, the minimum radius shall be 48 inches for 4-inch conduit and a 60-inch radius for 5-inch conduit, unless noted otherwise on the drawings. Standard radius conduit can be used for secondary electrical conduit if so specified on drawings.

2.6 CORROSION PROTECTION
A. Non-PVC-coated underground metallic conduit and fittings that are in direct contact with the earth or concrete shall be protected from corrosion. One of the following methods shall be used:
B. One application, half-lapped, of Minnesota Mining and Manufacturing Company "Scotchwrap" No. 51, Plymouth Rubber Co. "Plywrap 20" or Westape, Inc. 20 mil Pipe Wrap, or equivalent, shall be applied. A "Scotch Coat" No. 101 pipe coating resin treatment, or equivalent, will also be accepted.
   1. All elbows or bends shall have the wrap applied after the conduit is bent.
   2. Fittings shall have two separate applications of the above, half lapped and extending one tape width onto the adjoining ducts.
C. Factory coated PVC on rigid conduit.

2.7 MANHOLES - GENERAL
A. Manholes can be either precast concrete or cast-in-place as designated on the drawings.
B. Drainage shall be provided to keep the manholes free of water during construction.
2.8 MANHOLES - PRECAST CONCRETE

A. Manufacturer shall have documented experience in the manufacture of manholes for a minimum of three years.
B. Base course material shall be sand, 3 inches minimum compacted 95%.
C. Precast concrete: Air-entrained, 4,000 psi minimum compressive strength at 28 days.
D. Reinforcing: AASHTO HS-20; bridge loading.
E. Manhole Shape: As indicated on drawings.
F. Inside Dimensions: As indicated on drawings.
G. Wall Thickness: AASHTO HS-20; bridge loading.
H. Include 40-inch diameter grooved opening in top section for frame and cover for power manholes and 36-inch diameter grooved opening for Communication manholes.
I. Frame and Cover Sections: 36-inch diameter clear opening for power manholes and 30-inch diameter for communication manholes.
J. Include one 12-inch drain opening and two 1-inch ground rod openings in base, one each diagonally opposite corners, not less than 6 inches or greater than 12 inches from the wall.
K. Window for Duct Entry: Unless otherwise specified on drawings, nine 6-inch knockouts in three rows of three on 8.56-inch centers shall be provided on each wall with top row of knockouts not less than two feet below top of manhole. Refer to contract drawings for specific construction details.
L. Include cable-pulling irons opposite each duct entry.
M. Include inserts for cable racks on three-foot centers.
N. Include metal ladder in manhole, steps at 16 inches on center, ladder bolted to manhole neck.
O. Ram-Nek®, Kent Seal™, or approved equal sealants shall be used to seal the joints in the manhole.

2.9 MANHOLE ACCESSORIES

A. Manhole Frames and Covers: ASTM A48; Class 30B gray cast iron, machine finished with flat bearing surfaces. Covers shall be round and have "Electric" or "Signal" as designated on plans and "SNLA" in permanent lettering.
B. Sump Covers: ASTM A48; Class 30B gray cast iron.
D. Cable Rack Inserts: Steel channel insert with minimum load rating of 800 pounds, length to match cable rack channel. Locate 3 feet on center.
E. Cable Rack Channel: 1-1/2 x 3/4 inch steel channel wall bracket, 48 inch length, with cable rack arm mounting slots on 1-1/2 inch centers.
F. Cable Racks: ANSI/ASTM A659; steel channel, 1-1/2 x 3/4 x 14 inches with fiberglass reinforced polyester or porcelain cable supports and fastener to match mounting channel.
G. Manhole Ladder: Cast iron, suitable for manhole shape and construction, and hotdip galvanized.
H. Ground Rods: ¾-inch x 10-foot Copperweld.
I. Grade Rings: Pre-cast concrete (4000 psi minimum compressive strength at 28 days) with inside diameter equivalent to manhole opening specified in Part 2.9H. The ring shall have circumferential rebar #3 minimum with a trowel finish to provide a true plane within 1/8 inch, as determined with a 5-foot straight edge.

END OF SECTION
SECTION 27 08 10

OPTICAL FIBER TESTING AND MEASUREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Products and execution requirements relating to testing and documentation for optical fiber cabling for the communication systems, and supplements requirements found in related sections.

PART 2 - PRODUCTS

2.1 OPTICAL FIBER CABLE TESTERS

A. Ensure the field-test instrument is updated to the most recent software and firmware provided by the manufacturer prior to testing.

B. Optical loss test set (OLTS)
   1. Calculate the length of fiber links
   2. Multimode optical fiber light source
      a. Provide LED light sources with wavelengths of 850 nm (±30 nm) and 1300 nm (±20 nm)
      b. Output power of -20 dBm minimum
      c. The launch shall meet the launch requirements of TIA-526-14-C. (Encircled Flux)
   3. Singlemode optical fiber light source
      a. Provide dual laser light sources with central wavelengths of 1310 nm (±20 nm) and 1500 nm (±20 nm)
      b. Output power of –10 dBm minimum
   4. Power Meter
      a. Provide 850 nm, 1300 nm, 1310 nm, and 1500 nm wavelength test capability
      b. Power measurement uncertainty of ± 0.25 dB
      c. Store reference power measurement
      d. Store a minimum of 100 results in internal memory
      e. External computer interface (serial or USB)
   5. Acceptable Equipment:
      a. Fluke Networks, CertiFiber Pro
      b. Fluke Networks, DTX CableAnalyzer with DTX-EFM2 and DTX-SFM2 modules
      c. Exfo, MaxTester 940
      d. Approved equivalent

C. Optical Time Domain Reflectometer (OTDR)
   1. Shall have a color transmissive LCD display with backlight
   2. Rechargeable Li-Ion battery for 8 hours of normal operation
   3. Internal non-volatile memory and removable memory device with at least 16 MB capacity for results storage
   4. Serial and USB ports to transfer data to an external computer
   5. Multimode OTDR
      a. Wavelengths of 850 nm (± 20 nm) and 1300 nm (± 20 nm)
      b. Event dead zones typically of 0.5 m at 850 nm and 1.3 m at 1300 nm
      c. Attenuation dead zones 4.5 m at 850 nm and 10.5 m at 1300 nm
d. Distance range 3 km at 850 nm and 7 km at 1300 nm  
e. Dynamic range 15 dB at 850 nm and 14 dB at 1300 nm  

6. Single-mode OTDR  
a. Wavelengths of 1310 nm (± 25 nm) and 1550 nm (± 30 nm)  
b. Event dead zones typically of 1 m at 1310 nm and 1 m at 1550 nm  
c. Attenuation dead zones typically of 8 m at 1310 nm and 8 m at 1550 nm  
d. Distance range at least 60 km  
e. Dynamic range 26 dB at 1310 nm and 24 dB at 1550 nm  

7. Acceptable Equipment:  
a. Fluke Networks, OptiFiber Pro  
b. Corning Cabling Systems, OV-1000 OTDR  
c. Exfo, FTB-150 OTDR  
d. Approved equivalent  

D. Fiber Video Scope  
1. Field of view at least 250 µm  
2. Video camera and display showing magnified end-face image.  
3. Camera probe tips permitting inspection through adapters.  
4. Electronic storage of end-face image.  
5. Acceptable Equipment:  
a. Fluke Networks, Versiv (CertiFiber Pro, OptiFiber Pro or FI-7000)  
b. Exfo MaxTester 940  
c. Approved equivalent  

E. Fiber Cleaning Products  
1. Optical-grade cleaning fluids that leave no residue and are fast-evaporating  
2. Cleaning fluids in hermetically sealed packaging to prevent cross-contamination  
3. High-absorbency optical-grade fabric wipes (not paper)  
4. Acceptable Manufacturers: Sticklers; or approved Alternate  

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Products and execution requirements relating to testing and documentation for copper cabling for the communication systems, and supplements requirements found in related sections.

B. Test measurements shall be taken for all balanced-twisted pair cabling, including horizontal and backbone copper cables and wall-to-rack cables. Test all category cables in accordance with current TIA measurement specifications for that category of cabling with a field-test instrument meeting or exceeding Level IIIe accuracy. Provide test measurement results (in electronic format) a minimum of three weeks prior to substantial completion.

1.02 RELATED DOCUMENTS

A. Related Sections:
   1. 270000: Communications
   2. 270526: Grounding and Bonding of Communication Systems
   3. 270810: Optical Fiber Testing and Measurement
   4. 271100: Communications Equipment Room Fittings
   5. 271300: Communications Backbone Cabling
   6. 271500: Communications Horizontal Cabling
   7. 271600: Communications Connecting Cords Devices & Adapters

B. The latest versions of the following codes, standards, and guidelines shall be followed. Bring to ITS’ immediate attention where construction documents or conditions differ from requirements in codes, standards, guidelines and specifications.

C. The following standards:
   1. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standard
   2. ANSI/TIA-1152 – Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
   3. TIA TSB-155-A - Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T

D. The following guidelines:
   1. BICSI, Telecommunications Distribution Methods Manual (TDMM)
   2. BICSI, Information Transport Systems Installation Methods Manual (ITSIMM)

1.03 QUALITY ASSURANCE

A. All testing procedures and field-test instruments shall comply with applicable requirements of referenced standards.
B. Test measurements shall be performed by trained technicians who have successfully attended manufacturer training or BICSI Installer 2 copper training.

C. The Owner or the Owner’s Representative shall be invited to witness, review or both witness and review field-testing.
   1. Notify Owner’s Representative and Design Engineer of the testing start date, five (5) business days before testing commences.
   2. After final test measurements have been completed and submitted, the Owner’s Representative or Design Engineer will select a random sample of up to 10% of the installed links that the telecommunications contractor is to retest at no cost to the Owner. If more than 2% of the sample results differ in terms of the pass/fail determination, the contractor, under supervision of the Owner’s Representative, shall repeat 100% of the testing at no cost to the Owner.

1.04 SUBMITTALS

A. The following submittals are due at the Pre-Construction Phase, or prior to start of testing, in accordance with submittal requirements in Section 27 00 00 Communications:
   1. Names of individuals that will be performing the testing and their training certificates (from BICSI or manufacturer).
   2. Manufacturer’s cut sheet or specifications sheet for the field-test instrument to be used, along with calibration data sheet, including date of calibration.
   3. Sample Test Report, which shall show that the field-test instrument software and firmware is up-to-date (the most recent version). This sample test report shall also show all required test parameters as required by the referenced standards.

B. The following submittals are due a minimum of three weeks prior to substantial completion, in accordance with the submittal requirements in Section 27 00 00 Communications:
   1. Complete test measurement results indicating that all cable permanent links have passed. Submit (2) electronic versions on (2) CD/DVD-R or USB Flash Drive (one for the Owner’s Representative and one for the Design Engineer):
      a. Microsoft Excel 2007 (Manifest)
      b. Test measurement results in their native format and the manufacturer’s PC software to read test results.
      c. Test shall be organized by media in binders with index and pagination
      d. Manufacturer factory cable spec sheet and test results for shipped cable.

C. The following submittals are due Post-Construction, in accordance with the submittal requirements in Section 27 00 00 Communications:
   1. On final electronic file submittal (CD/DVD-R or USB Flash Drive), which is to include record drawings, O&M manuals, etc., also include files for all valid test results (as submitted previously).

PART 2 - PRODUCTS

2.01 FIELD-TEST INSTRUMENT

A. The field-test instrument shall:
   1. Be calibrated field-test instruments as recommended by the manufacturer, or at least within one year of project test measurements.
2. Contain the most recent software and firmware provided by the manufacturer prior to testing.
3. Be Level IIIe accuracy.

B. Administration
1. The test measurement result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.
2. The test result records saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records.

C. Approved Products:
1. Fluke DSX-5000 and all associated modules
2. Or Pre-Approved Equivalent: Provide supporting documentation that substantiates claim.

PART 3 - EXECUTION

3.01 GENERAL

A. All outlets, cables, patch panels and associated components shall be fully assembled, secured/affixed to final mount location, and labeled prior to field-testing. Any test measurements performed on incomplete systems shall be redone on completion of the work.

B. Tester shall be configured with the manufacturer and model number of cable and connectors, where applicable.

C. The installed twisted-pair links shall be tested from the telecommunications room to the telecommunication wall outlet in the work area for compliance with the “Permanent Link” performance specification.

D. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. The test equipment (tester), including the appropriate interface adapter, shall comply with the accuracy requirements for Level IIIe field-test instruments as defined in ANSI/TIA-1152. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 2 of ANSI/TIA-1152 (Table 2 in this TIA document also specifies the accuracy requirements for the Channel configuration).

E. One hundred percent of the installed cabling links shall pass the requirements of the referenced standards. Diagnosed and correct any failing link.
   1. Note and follow with a new test measurement the corrective action to prove that the corrected link meets the performance requirements.

F. A PASS or FAIL result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field-test instrument manufacturer must provide documentation as an aid to interpret results marked with asterisks. To which extent '*' results shall determine approval or disapproval of the element under test shall be defined in the relevant detail specification, or agreed on as a part of a contractual specification.
G. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any FAIL, FAIL* or PASS* result is considered a FAIL for the link-under-test for this contract. In order to achieve an overall Pass condition, the results for each individual test parameter must yield a rating of PASS. The “*” shall not be turned off on the test instrument.

H. The records for each cable test measurement shall be provided to the owner a maximum of two weeks after substantial completion in Excel format (manifest) and the native format to the field-test instrument. The Owner can supply an Excel spreadsheet template (manifest) upon request for the contractor’s use.

3.02 PERFORMANCE TEST PARAMETERS

A. Test parameters for category 3 Cables:
   1. Wire map
   2. Length
   3. Propagation delay
   4. Delay skew
   5. DC Loop Resistance

B. Test parameters for Category 5e cables (up to 100 MHz) and Category 6 cables (to 250 MHz):
   1. Wire Map
   2. Length
   3. IL - Insertion Loss
   4. NEXT – Near End Cross-Talk
   5. PSNEXT - Power Sum Near End Crosstalk
   6. ACRF - Attenuation to Crosstalk Ratio – Far End
   7. PSACRF - Power Sum Attenuation to Crosstalk Ratio – Far End
   8. Return Loss
   9. Propagation Delay
   10. Delay Skew
   11. DC Loop Resistance for balanced and unbalanced signals
       a. Max 21 ohms

C. Test parameters for Category 6A cables (up to 500 MHz):
   1. Wire Map
   2. Length
   3. IL - Insertion Loss
   4. NEXT – Near End Cross-Talk
   5. PSNEXT - Power Sum Near End Crosstalk
   6. ACRF - Attenuation to Crosstalk Ratio – Far End
   7. PSACRF - Power Sum Attenuation to Crosstalk Ratio – Far End
   8. PSANEXT - Power Sum Alien Near End Crosstalk
   9. PSAACRF - Power Sum Alien Attenuation-to-Crosstalk-Ratio from the Far End
   10. RL - Return Loss
   11. Propagation Delay
   12. Delay Skew
   13. DC Loop Resistance for balanced and unbalanced signals
       a. Max 21 ohms

D. Alien Crosstalk sampling
1. Shall be performed for Category 6 cables used for 10Gb/s, and all Category 6 cables in the same bundle as well as adjacent links, using a sampling plan. An acceptance quality level (AQL) of 0.4%, normal inspection, general inspection level I as defined in ISO 2859-1 for populations of up to 500,000 links shall be used. The following table represents this sampling level:

<table>
<thead>
<tr>
<th>Total number of links (N)</th>
<th>Sample size (No. of links to test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – 33</td>
<td>3 or 0.1 x N (whichever is greatest)</td>
</tr>
<tr>
<td>34 – 3,200</td>
<td>33</td>
</tr>
<tr>
<td>3,201 – 35,000</td>
<td>126</td>
</tr>
<tr>
<td>35,001 – 150,000</td>
<td>201</td>
</tr>
<tr>
<td>150,001 – 500,000</td>
<td>315</td>
</tr>
</tbody>
</table>

E. Test parameters for other cables:
1. Continuity to the remote end;
2. Shorts between any two or more conductors;
3. Crossed pairs;
4. Reversed pairs;
5. Split pairs; and,
6. Any other miss-wiring.

### 3.03 CATEGORY 6A FIELD INSTALLABLE MODULAR PLUG

A. Modular plugs shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

B. 100% of all installed cable segments shall be tested, partial or sample testing shall not be acceptable.

C. Test procedure shall adhere to the method for testing a Modular Plug Terminated Link as described in TIA-568.2-D Annex F.

D. The MPTL shall be tested with a Permanent Link Adapter on the Main Unit and a Patch Cord Adapter Suitable for Category 6A testing on the Far End or Remote Test Equipment. Channel adapters shall not be used.

E. Test limits shall be set to meet the MTPL performance requirements defined in TIA-568.2-D Annex F.

F. The patch cord adapter used on the far end of the MPTL shall meet the requirements for Category 6A patch cord test head as qualified per TIA 568.2-D Annex C or D.

G. The detailed test results are to be provided to owner and submitted electronically to Manufacturer for warranty acceptance for each tested link and shall contain the following information:
1. The overall Pass/Fail evaluation of the link-under-test
2. The date and time the test results were saved.
3. The identification of the customer site as specified by the end-user
4. The name of the test limit selected to execute the stored test results
5. The name of the person(s) performing the test
6. The version of the test firmware and the version of the test limit database held within the test instrument
7. The manufacturer, model and serial number of the field-test instrument
8. The adapters used
9. The factory calibration date
10. Specific performance tests shall include:
   a. Wire Map
   b. Propagation Delay values, for all four pairs
   c. Delay Skew values, for all four pairs
   d. DC Resistance values, for all four pairs
   e. Insertion Loss, worst case values for all four pairs
   f. NEXT, worst case margin and worst case values, both directions
   g. PS NEXT, worst case margin and worst case values, both directions
   h. ACR-N, worst case margin and worst case values, both directions
   i. PS ACR-N, worst case margin and worst case values, both directions
   j. ACR-F, worst case margin and worst case values, both directions
   k. PS ACR-F, worst case margin and worst case values, both directions
   l. Return Loss, worst case margin and worst case values, both directions
   m. Time domain Crosstalk data if the link is marginal or fails
   n. Time Domain Reflectometer data if the link is marginal or fails

3.04 ADMINISTRATION

A. Test results documentation
   1. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”.
   2. The test results documentation shall be available for inspection by the Owner or the Owner’s representative during the installation period. The contractor shall retain a copy to aid preparation of as-built information.
   3. The records for each test shall be provided to the owner a maximum of one week after substantial completion in Excel format and the native format to the test instrument. The Owner can supply an Excel spreadsheet template upon request for the contractors use.
   4. Circuit IDs reported by the field-test instrument shall match the label ID specified by the Owner.
   5. The detailed test results documentation data is to be provided in an electronic database for each tested link and shall contain the following information
      a. The identification of the customer site as specified by the end-user
      b. The name of the standard selected to execute the stored test results
      c. The name of the test personnel
      d. The date and time the test results were saved in the memory of the tester
      e. The manufacturer, model and serial number of the field-test instrument
      f. The version of the test software and the version of the test standards database held within the test instrument
      g. The copper identification number
      h. The length for each copper cable
      i. The overall Pass/Fail evaluation of the channel test.
   6. Provide summary report of all cables tested in PDF format.
   7. Provide full tester report for each cable tested in PDF format.
8. Ensure that sweep frequency measure graphs are included in reports.

B. As indicated in 27 00 00, all documentation will be provided in soft and hard bound copies. Hard copies are to be included in an indexed binder with each test or document residing in its own section and listed in the table of contents for easy reference.

END OF SECTION
SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes basic communications room requirements, and supplements requirements found in related sections. Refer to “T” series drawings for specific communication room requirements:

B. Related Sections
   1. 270000: Communications
   2. 270526: Grounding and Bonding of Communication Systems
   3. 270810: Optical Fiber Testing and Measurement
   4. 270820: Copper Testing
   5. 271300: Communications Backbone Cabling
   6. 271500: Communications Horizontal Cabling
   7. 271600: Communications Connecting Cords Devices & Adapters

PART 2 – PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA-569.
B. Cable Support: NRTL listed, Plenum rated.
C. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems.
   1. Outlet boxes will be no smaller than 4-11/16 “square and 3 inches deep.

2.2 CABLE RUNWAYS

A. UL Classified and Listed.
B. Rung Spacing: 12 inches on center.
C. Furnish and install all connectors and fittings, as required. Where cables drop out of the cable tray, “drop-out” fittings shall be furnished and installed.
D. Cable tray shall be approved as a ground conductor or ground conductor clamps shall be furnished and installed for each section with appropriate sized ground wire between sections.
E. Material: Steel.
F. Finish: Black powder coat
G. Approved Products:
   1. Chatsworth Universal Cable Runway, # 10250-1xx
2. B-LINE Tubular Stringer Style Runway, # SB17UxxBFB
   Where
   a. xx = inches, sized as indicated on drawings

2.3 BACKBOARDS
   A. The Backboards: A/C grade plywood, void free, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).
   B. Plywood must be kiln dried to a maximum moisture content of 15 percent.
   C. Must be treated on all sides with at least two coats of fire-resistant, painted flat white.
   D. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry".
   E. Mount plywood with fire stamp to room interior. Stamp to be masked during painting and uncovered upon completion.
   F. Provide in close-out submittals Bills Of Lading to prove fire-retardant properties of plywood and paint.
   G. Secure sheets to studs at regular 18” or fewer intervals with screws penetrating into studs a minimum of 3/4”.

2.4 CATEGORY 6 & 6A PATCH PANELS
   A. Angled:
      1. Standard angled in 128-degree form, or Recessed Angled Patch Panel in a “W” footprint
      2. 24-port 1RU, 48-port 2RU and 72-port 2RU configurations available
      3. Modular for insertion of jacks to denote color-coded ports
      4. Write-on blocks or strip for 24- and 48-port versions
      5. 16-gauge steel with White port numbering on a Black finish
      6. Recessed-Angled rear lacing bar sold separately
      7. Category 5e, 6 and 6A rated
      8. Accepts same jack style and footprint as workstation area outlets (no “panel jack” required)
   B. Approved Products – Modular (Empty)
      1. Leviton Angled 24-port modular patch panel, # 49256-H24
      2. Leviton Angled 48-port modular patch panel, # 49256-H48
   C. Approved Products –110 punchdown
      1. Leviton Angled 24-port CAT6A patch panel, # 6A587-U24
      2. Leviton Angled 48-port CAT6A patch panel, # 6A587-U48
      3. Leviton Angled 24-port CAT6 patch panel, # 69587-U24
      4. Leviton Angled 48-port CAT6 patch panel, # 69587-U48

2.5 LC FIBER OPTIC PATCH PANEL/ENCLOSURES
   A. Fiber Termination:
      1. Fiber optic cables shall be terminated with LC Terminations and housed in [1RU] [2RU] [4RU] rack-mount enclosures providing protection for the terminated fibers. LC connector shall accept 900µm buffered [XG 50/125um OM4 / OS2 single mode] fiber
2. Fiber-Optic connectors shall be no-epoxy/no-polish and terminate with 900um tight-buffered fiber. LC connectors shall meet the most recent revision of TIA-568 standard, and its published addenda.
3. Each LC connector shall be held by a LC duplex coupler snap-in adapter plate. Adapter plates shall be installed into rack-mount fiber optic enclosure.
4. Fiber optic enclosures shall be capable of containing 72 individual LC connectors per RU, or 36 LC duplex connectors.
5. For inside plant, utilize pig tail splicing connectors, and for OSP fiber, utilize fan out kits for termination of the fiber.
6. Adapter plates shall be precision-molded, utilize Zirconia-ceramic ferrules, and color-coded to match fiber type and application.
7. MTP conversion cassettes shall be utilized where conversion of 12- or 24-strand MTP backbone is needed to separate into individual 8-strand MTP or single-strand LC connectors.

B. Approved Products
1. Leviton 2RU Opt-X SDX Fiber Enclosure, # 5R2UH-S06
2. Leviton FastCAM LC connector, Multimode Aqua, # 49991-LLC
3. Leviton FastCAM LC connector, Singlemode Blue, # 49991-SLC
4. Leviton 12-strand Fan-out kit, 36", # 49887-12L
5. Leviton SDX 12-strand LC adapter plate, Multimode Aqua, # 5F100-2QL
6. Leviton SDX 24-strand LC adapter plate, Multimode Aqua, # 5F100-4QL
7. Leviton SDX 12-strand LC adapter plate, Singlemode Blue, # 5F100-2LL
8. Leviton SDX 24-strand LC adapter plate, Singlemode Blue, # 5F100-4LL
9. Leviton SDX MTP-LC cassette, 12-strand, FMx012CAC0yy
   a. where: 
      x = fiber type A=OS2, E=OM3, F=OM4, G=OM4+
   b. yy=polarity (A, C, BC (B Core) or BE (B Edge))

2.6 FIBER OPTIC SPLICING

A. Fiber Optic Splice Closures
1. Outdoor
   b. Minimum size as required to support the quantity and configurations of cables and splices.
   c. Closures shall be re-enterable and made of injection molded high-density thermoplastic with a neoprene gasket providing an air-tight and water-proof seal.
   d. Furnish with organizers for splice trays, quantity as required.
   e. Furnish and install appropriate closure end plates and end plate grommets as required to support up to six cables, based on location, of various sizes. Quantity of cables per Drawings.
   f. Rubber tape for sealing around cables to provide a seal that compensates for expansion and contraction associated with temperature cycling.
   g. Mounting hardware as required.
   h. All closure, end plates, grommets, sealant, sealing tape, miscellaneous mounting hardware, and splicing accessories shall be by the same manufacturer.
   i. Acceptable Manufacturer: Preformed Line Products Coyote Series, or approved equal

2. Fiber Optic Splice Trays.
a. Furnish and install splice trays as required to house all splices in splice enclosures (OSP) and in optical fiber termination/patch panels (ISP).
b. Splice trays shall be designed to house fibers for operation at 1550nm wavelength, equipped with integral buffer tube/fiber jacket strain relief, and designed to attach 2.0 mm, 2.8mm and 3.0 mm buffer tubes and cable jackets.
c. Splice trays shall be designed to house and manage a minimum of 1 meter (3.2 feet) of 900 micron and/or coated optical fibers.
d. Splice trays shall house and manage the fibers and splice protection for a minimum of 12 fiber splices.
e. Furnish and install one splice tray for each outside plant buffer tube installed whether the buffer tube contains 6 or 12 optical fiber strands.
f. Splice trays shall be furnished with the appropriate splice holder chip for the splice protection method employed by the Contractor.
g. Contractor may use:
   1) Heat shrink splice protection with integral steel support rod (preferred method)
   2) Glass capillary and UV curative encapsulated protection
   3) RTV Silicone encapsulated protection (for existing splice trays only)
   4) Approved Products: (must match enclosure manufacturers)

2.7 COPPER CABLE SPLICING

A. Copper Splice Enclosures
   1. Re-enterable, stainless steel closure with a neoprene liner.
   2. Minimum size as required to support the quantity and configurations of cables and splices.
   3. Appropriate end plates and washers as required to accommodate the various cable diameters and quantities.
   4. Drillable end plates as required to support cable quantities and configurations other than supported by pre-manufactured end plates.
   5. End plates shall be provided with ground connection point.
   6. Size the closure based on splice quantity and end plate diameter requirements.
   7. Size drillable end plates based on cable O.D., quantity and manufacturers recommendations.
   8. Furnish and install the bonding kit to bond all cable shields that enter closure.
   9. Furnish and install mastic sealing tapes and end plugs to seal closure as required.
   10. Furnish and install re-enterable encapsulant and buffers as recommended by the manufacturer.
   11. The ground/bond kits, and washers shall all be by the same manufacturer.
   12. Approved products:
      a. Performed Line Products Armadillo Series
      b. Pre-approved equal.

B. Copper Splice System
1. Straight splice and half-tap as required by application.
2. 25-pair splice modules.
3. Filled splices for outside plant splice applications.
4. Dry splices for inside plant splice applications.
5. Furnish and install quantity of splice modules as required to splice all cables furnished and installed as part of this project and existing cables to be spliced.
6. Approved Products:
   a. 3M 710 Series Modules

**2.8 STANDARD RELAY RACKS**

A. All equipment racks and their hardware shall match in appearance and shall be provided by a single manufacturer.
   1. Universal hole pattern on the front and rear flanges, and threaded mounting holes on both sides of rack assembly for management
   2. Brackets with an eight inch mounting floor plate on the front and rear.
   3. Racks will be black in color.
   4. Provide 32 spare screws per rack.
   5. Horizontal cable support bar on rear of each patch panel/cross connect block panel to support hook and loop (Velcro) strain reliefs. Cables will not rely on terminations for cable support.
   6. Hook and loop (Velcro) cable strain relief system on rear of rack to support horizontal and backbone cables. Tie-wraps are specifically prohibited.
   7. Hook and loop (Velcro) horizontal and vertical cable management on front of rack for dressing patch cable and cross connect wiring. Tie-wraps are specifically prohibited.
   8. Hook and loop (Velcro) cable management system independent of cable management to properly dress the electronic equipment power cords through the rack maintaining as much clearances between the two as possible. Tie-wraps are specifically prohibited.
   9. Bonding and grounding cables for all equipment not directly bolted to equipment rack (i.e. shelf mounted electronic equipment, etc.).
   10. Surge protected power strip as described in this specification.
   11. All hardware, supplementary steel, channel and supports as required properly assembling the rack and supporting it to the building structure.
   12. All equipment racks and their hardware will match in appearance and will be provided by a single manufacturer.
      a. Furnish and install vertical wire management channels on both sides of racks.
      b. Furnish and install horizontal wire management units, quantity and type as indicated on the drawings.
      c. Furnish and install ground terminal block/lug for each rack and #6 ground wire to room ground bus bar.

B. Include two each vertical cable managers per standalone rack, or one vertical manager between each rack, and one at each end of a row.

C. Approved Products:
   1. CPI Universal 45 RU rack, # 55053-703

**2.9 VERTICAL CABLE MANAGERS**

A. All cable managers and their hardware shall match in appearance and shall be provided by a single manufacturer.

B. Vertical cable managers shall be dual-sided (front and rear), and include doors.
C. Include two each vertical cable managers per standalone rack, or one vertical manager between each rack, and one at each end of a row. 10” cable managers shall be installed at the outside of each row of racks, including rows with a single standalone rack. 12” vertical wire managers shall be installed between 2 connected side-by-side racks.

D. Approved Products:
1. Chatsworth Velocity 10” Channel Vertical Cable Manager, # 13904-703
2. Chatsworth Velocity 12” Channel Vertical Cable Manager, # 13905-703
3. Chatsworth Evolution 10” Channel Vertical Cable Manager, # 35523-E03
4. Chatsworth Evolution 12” Channel Vertical Cable Manager, # 35524-E03

2.10 RACK ACCESSORIES

A. Rear Cable Management Bars
1. Leviton Recessed-Angled rear strain relief bar, 4W006-AMB
2. Leviton Angled Rear Cable Management Bar, 49006-AMB
3. Leviton Flat High-Density Cable Management Bar, 1RU, 49005-DMB

B. Blank Panel Inserts
1. Leviton 1RU Blank Panel, #49254-BP1
2. Leviton 2RU Blank Panel, #49254-BP2
3. Leviton 4RU Blank Panel, #49254-BP4

2.11 110 PUNCH-DOWN BLOCKS

A. Quantity:
1. Provide sufficient quantity to terminate all cabling plus one for all media to allow for growth in all communication rooms.

B. Verified to meet or exceed TIA-568 Category 5e component specifications.
1. UL listed.

C. Connecting Blocks
1. Category rated to match category rating of cable as required by application.
2. Material: Polycarbonate UL 94 V-O
3. Insulation Displacement Contacts
   a. Contact material: Phosphor bronze
   b. Contact Plating: Tin/lead solder
   c. Accepts solid or 7 conductor stranded 26-22 AWG copper conductors
   d. Furnish and install punch down blocks with labels and label holders.
   e. Furnish and install block accessories and cable management accessories.
   f. Furnish and install 25% spare capacity, block space and connecting clips on all horizontal distribution punch down blocks in each closet.

D. Approved Products:
1. Leviton CAT5e wall-mount wiring block kit, 100 pr, with legs and C4 clips, # 41AB2-1F4
2. Leviton 110-style horizontal cord manager, with legs, # 41A10-HCM

2.12 BRAIDED CABLE SLEEVES

A. Provide braided cable sleeves for cabling in rooms.

B. Polyester expandable sleeving: Flame-retardant and halogen-free.

C. Acceptable Manufacturer:
1. Dell City
2. JDD Tech
3. Approved alternate

2.13 BUILDING ENTRANCE PROTECTION

A. For each copper OSP cable that extends beyond the drip line of the building, a single cable entrance protector is required at each end.
1. 100-pair as required by application.
2. Housing and cover constructed of 18 gauge steel, epoxy powder coated.
3. Input terminations shall be [stub] 110 type. [Furnish stub length as required. Furnish splice case for stub connected protectors, size as required.]
4. Output terminations shall be 110 type.

B. Furnish 5 spares per protector.

C. Approved Products
1. Systimax 100-pair stub-in protector panel, # 489ACC1-100
2. Systimax protection fuse for data, 300V, with heat coil, # 760033951
3. Systimax protector module for voice, 235V, # 760031708

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This section includes information on horizontal communications cabling supplementing requirements found in the related sections.

B. Most of the campus horizontal cabling is installed and functional. The scope of work includes verification of functionality of the existing horizontal cabling as it pertains to areas of renovation within the project (as indicated on the plans).
   1. Contractor shall provide and furnish all necessary cabling system accessories required for a fully-functional horizontal cabling system for the renovated areas of the project. Refer to plans for more information.

C. Related Sections
   1. 270000: Communications
   2. 270526: Grounding and Bonding of Communication Systems
   3. 270820: Copper Testing
   4. 271100: Communications Equipment Room Fittings
   5. 271600: Communications Connecting Cords Devices & Adapters

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

A. Conduit and EMT required for Communications cabling pathway in/out of cross connect closets and in/out of wall cavities at the work area where ceiling is inaccessible.

B. Rings (and strings) with conduit connecting tabs for the mounting of NEMA rated faceplates where required.

C. Drag line or pull string at the ring fished through EMT or conduit to the other end for installing 4 pair and multi-pair cables.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all the required material whether specifically addressed in the Specification or not. Verify in-field and with the Owner’s IT representative that the existing in-place telecommunications horizontal cabling system is fully operational.
   1. The horizontal portion of the telecommunications cabling system extends from the work area outlet (WAO) to the termination to the nearest Telecommunications Room. Refer to the drawings for more information regarding locations.

B. This document specifies the products and methods of execution required to support a Category 6A Modular Plug Terminated Link (MPTL) in accordance with TIA 568.2-D Annex F. The use of a MPTL should be limited to those applications where termination of horizontal cables on a
Telecommunications Outlet (jack) has been determined to be impractical and when the device being serviced is not often moved or rearranged.

1.04 SYSTEMS DESCRIPTION

A. Horizontal copper cabling system consists of rated cables with four unshielded twisted pairs of solid annealed copper wrapped in plenum rated insulation with an overall plenum rated jacket with a wire thickness of 23 AWG. Each four-pair cable is terminated onto 8 position 8-conductor rated connectors using 110 style IDCs. Connectors are placed into NEMA rated faceplates at the work area and placed into rack mounted patching panels in the equipment/networking rooms.

B. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
1. TIA-568 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling will contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices will not be installed in the horizontal cabling.
   a. A work area includes the components that extend from the telecommunications outlet/connectors to the station equipment.
   b. The maximum allowable horizontal cable length is 290 feet. This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The maximum allowable length does not include an allowance for the length of 18 feet in the horizontal cross-connect.

1.05 MANUFACTURER QUALIFICATIONS

A. Manufacturer shall be a telecommunications product manufacturer with at least 20 years of experience.

B. Manufacturer shall be ISO 9001 certified manufacturer and shall employ Six Sigma methodology in its manufacturing process.

C. Where a specific manufacturer is called out by name, this is the preferred standard. If substitutions are allowed, they are at the discretion of the Owner and based on performance, suitability, quality, administrational requirements, warranty and other factors deemed important to the Owner.

D.

1.06 TESTING AGENCY QUALIFICATIONS

A. Independent testing agencies shall be nationally recognized as having the expertise to independently verify copper and optical fiber cabling systems and components.

B. Testing Agency Qualifications: Must be a NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Telecommunications Pathways and Spaces: Comply with TIA-569.

E. Grounding: Comply with TIA-607.

1.07 WARRANTY

A. Contractor shall provide a 1 year parts and labor warranty against defective workmanship and/or system component failure.

B. Contractor shall execute a Limited Lifetime Product & Performance Warranty covering all components, equipment and workmanship which shall be provided to the Owner, submitted in writing with system documentation. The warranty period shall begin on the system's first use by the owner.

C. Horizontal channels shall be completed with end to end solutions, such as the Berk-Tek Leviton Technologies Solutions. Factory-terminated copper and/or fiber optic patch cords from the solutions provider must be used in order to be eligible for the applicable channel performance guarantees.

D. As further described below, the “Supplier” shall warrant to the customer (“Buyer”) that the CAT 6 certified network installations will exceed the defined TIA-568 series industry specifications in force at the time of product purchase. Furthermore, the products that comprise the certified Cabling System will meet or exceed the applicable product performance specifications in effect at the time of manufacture.

E. This warranty covers the copper and fiber optic permanent links of the network as defined by TIA-568 which includes the cable and connecting hardware. This warranty will be extended to include the entire channel provided that the applicable patch cords and equipment cords are utilized, and all products are installed within areas protected from outside elements.

PART 2 - PRODUCTS

2.01 GENERAL

A. The Electrical Code referred to in these specifications is the National Electrical Code as currently adopted by the State of CA. All work will be provided in strict compliance with the Electrical Code and all regulations that may apply.

B. Where standards exist, for a particular category, products used on this project will be listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL), and be approved or listed for the intended service and application.

C. These specifications do not undertake to repeat the requirements of codes, regulations or NRTL listing or labeling instructions. The Specifications or Drawings may require items or work beyond the requirements of applicable codes or regulations. The stricter, higher quality, greater quantity or higher cost will be provided. It is incumbent on the Installer, material and equipment
suppliers to meet these specifications, applicable codes, regulations, and NRTL listing agency restrictions.

2.02 MANUFACTURER

A. The word "Manufacturer" will include the Manufacturer, the Manufacturer’s Representative, the Distributor, the Fabricator, and the Supplier of the particular classification of equipment, system, product, and material.

B. All work, equipment, and systems will be manufactured, provided, repaired, installed, and tested in accordance with the latest edition and all current amendments of the applicable publications and standards of the organizations listed below as of the date of the Contract Documents. When the Specification requirements exceed the requirements of these publications and standards the Specifications will govern:

1. State Building Code (SBC)
2. Building Department Inspectional Services
3. American Society for Testing and Materials (ASTM)
4. Underwriter’s Laboratories, Inc. (UL)
5. Insulated Cable Engineers Association (ICEA)
6. National Electrical Manufacturers Association (NEMA)
7. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
8. American National Standards Institute, Inc. (ANSI)
9. National Fire Protection Association (NFPA)
10. Local Electric Code
11. Department of Public Safety (DPS)
13. Department of Labor USA. Safety and Health Regulations for Construction (OSHA)
14. Energy Codes
15. National Electrical Contractors Association (NECA)
17. Federal Communications Commission (FCC)
18. Utilities Serving Project.
19. Fire Department.
22. Any and all Federal, State and Local Standards, Codes and Authorities having Jurisdiction.
23. In addition, all phases of the Structured Cabling System installation will adhere to applicable Local Area Network (LAN) Specifications of the Institute of Electrical and Electronics Engineers (IEEE), Electronics Industry Association/Telecommunications Industry Association (TIA/EIA), American National Standards Institute (ANSI), and Building Industry Consulting Service International (BICSI). The entire system and all components will be NRTL certified to appropriate TIA/EIA performance rating Category, Latest TIA Standards 455, 492.CAAAB, 492.AAAC, 492.AAAD, 568, and (SP-4195-B and SP-4195-B-1), 569, 570, 606, 607 and 758 (latest revisions), TIA/EIA TSB 67, TSB 72, TSB 75, TSB 95 and other standards as applicable.

C. The Installer will have available at the job site at all times one copy of the latest edition of the Electrical Code, TIA and BICSI Standards applicable to the work as specified within this document.
D. The above requirements will not in any way limit responsibility or requirements to comply with all other codes, standards and laws.

E. Material, equipment, enclosures, and systems will be designed for use as required to suit the conditions, exterior or interior operation, dust tight, water tight, explosion-proof, or other special types.

2.03 UTP PIN/PAIR TERMINATION ASSIGNMENT

A. The UTP cabling systems will have TIA/EIA T568B pin/pair termination assignment. All conductors provided will be properly and consistently terminated at both ends throughout the entire systems. Maintain proper untwist of pairs and removal of jacket per TIA and BICSI.

2.04 SYSTEM PERFORMANCE

A. Horizontal four pair Category 6A copper cabling system shall be capable of supporting 10G Base-T applications for a total distance of 100 meters with equipment cords.

B. System shall provide “future proof” channel performance and guaranteed margins as noted in this document and is guaranteed to exceed TIA-568 Category specifications for Insertion Loss, NEXT, PSNEXT, ACR, PSACR, ELFEXT, PSELFEXT and Return Losses 500 MHz for 6A. The system is also guaranteed 10 dB PSACR headroom for 6A cabling.

2.05 SYSTEM PERFORMANCE

A. CAT6A Unshielded (U/UTP, or UTP) Systems
   1. Horizontal UTP Category 6A 23AWG copper cabling system shall be guaranteed to exceed all TIA-568 link and channel performance requirements and be capable of supporting 10G Base-T (802.3an) and ISO/IEC 11801 Class EA applications for a total distance of 100 meters with equipment cords. System is guaranteed to meet all Cat 6A requirements for short links and channels down to a 10 foot link (5 meter channel) with a guaranteed 4 dB margin of Alien Crosstalk. Field testing is not required for Alien Crosstalk clearance.
   2. Basis of Design is Berk-Tek Leviton Technologies CX6850 Cat6A Premium UTP System
   3. CAT6A Performance Parameters, headroom over TIA-568 standard:

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<th>PSNEXT</th>
<th>ACR-F (ELFEXT)</th>
<th>PSACR-F (PSELFEXT)</th>
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<th>PSACR-N</th>
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<td>4 dB</td>
<td>7 dB</td>
<td>7 dB</td>
<td>5 dB</td>
<td>11 dB</td>
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</tbody>
</table>

2.06 SOURCE QUALITY CONTROL

A. All materials shall be purchased from Distributors authorized by system Manufacturers to sell new and unused components.

2.07 CATEGORY JACKS

A. Communications Faceplate ports shall contain Category jacks which are matched to cable. Jacks shall be terminated to the Horizontal Cabling and inserted into the Communications Faceplate.
B. **Connection Reliability**
   1. Use connectors with 50-μm gold-plated tines (as specified by TIA standards), as well as designs that distance the connection point between the connector tines and plug from the arcing damage.
   2. Connectors should also meet contact resistance requirements found in the IEC 60512-99-001 standard covering connectors for electronic equipment.

C. **CATEGORY 6A JACKS:**
   1. Provide modular type Category 6 information outlets for 23/24AWG copper cable. These Category 6A (CAT6) connectors shall be individual snap-in style, and exceed compliance with TIA-568 specifications. The connectors shall comply with the following:
      a. Be 8-position/ 8 conductor (8P8C, RJ45-style) modular jacks.
      b. Utilize a universal Keystone-style insertion footprint as the manufacturer’s main “flagship” line of products.
      c. Comply with FCC Part 68; UL listed and CSA Certified.
      d. Termination of all connectors shall be rear 110-type insulation displacement connectors (IDC) with solder-plated phosphor bronze contacts.
      e. IDC posts shall employ a mechanism to allow for terminations without a complete untwist of each pair of conductors.
      f. The connector shall provide a ledge directly adjacent to the 110-style termination against which the wires can be directly terminated and cut in one action by the installation craftsman.
      g. Connector wiring label shall provide installation color codes for both T568A and T568B wiring schemes on separate labels.
      h. Jacks shall employ “Retention Force Technology” or similar functionality involving polymer springs above tines for support and longevity of unimpeded physical conductor contacts.
   2. **Approved Products:**
      a. Leviton eXtreme CAT6A QuickPort Module # 61110-R*6
         Where * = one of 13 colors. See drawings or check with Owner for application.

**2.08 UTP CABLE**

A. **NETWORK DATA CABLES**
   1. Provide 4-pair, 100-Ohm balanced unshielded twisted pair (UTP) Cables for each data outlet designated.
   2. All UTP cables passing through air handling space shall be PLENUM-rated (CMP). Cables not passing through air handling spaces may be PVC (CMR) jacketed. Some buildings will require the use of Plenum cable. The contractor is solely responsible for verifying the construction requirements and installing the correct cable. Failure to provide CMP cable in Plenum required spaces will result in the contractor removing and replacing the cable at their own expense.
   3. **Cable jacketing:**
      a. Color Coding standard for patch cables and jacks:
      b. Voice - white cable and jacks
      c. Data - blue cable and jacks
      d. Wireless Access Points - green cable and jacks
      e. Security, video - yellow cable and jacks
      f. Emergency Speakers – orange cable and jacks
4. Cable shall be independently verified for flammability by UL and listed under file number E138034 and shall comply with NEC article 800, NFPA 70, and [CMP (NFPA 262, UL 910) or CMR (ANSI/UL 1666, IEC 332-1)].

5. Copper clad aluminum cables are not permitted. Installation of such will be cause for the necessity of removing the cabling and the installation of copper cables at the contractor’s expense.
   a. Any costs associated with project delays caused by the installation of these cables and the removal and installation of acceptable cables will be borne by the contractor.

B. CAT6A UTP cable shall conform to the following requirements:
   1. CAT6A Unshielded twisted-pair cable (U/UTP, or UTP)
   2. 100-Ohm, 23 AWG, CAT 6A 4-pair balanced unshielded twisted pair solid annealed copper
   3. Cable shall be characterized to 750 MHz and UL/ETL Listed by the Manufacturer printed on the cable jacket and package, as well as ETL Verified to TIA-568 Category 6A and ISO/IEC 11801 Class E_A requirements for channel, link and component performance to support IEEE 10GBASE-T (802.3an) networks
   4. Maximum Cable Outer Diameter: 0.275”.
   5. Documentation available from an independent third-party testing agency that verifies through random sampling that cable components perform at or above the levels contained on their product specifications, not simply at or above the standard.
   6. Guaranteed cable balance improves overall performance and reduces emissions which results in error-free performance up to 10 Gigabit Ethernet with full duplex transmission
   7. Provided on spools to reduce risk of kinking cable upon deployment
   8. Cable shall be Plenum-rated (CMP) for any location where plenum cable is required.
   10. Meet or exceed Channel margin guarantees as stated above under System Performance
   11. Approved Products:
       a. Berk-Tek LANmark XTP, CAT6A CMP, 1000’ reel
       b. Berk-Tek LANmark XTP, CAT6A CMR, 1000’ reel

2.09 OUTLET MOUNTING

A. Wall-plates
   1. Wall plates (or “faceplates”) provide information outlets to the work area. Contractor shall provide and install single gang faceplate kits to allow up to six data or voice jacks as required for all work area outlets, workstation base feeds, and unused telecom backboxes and furniture openings. Faceplates shall:
      a. Utilize a Quickport (“keystone”-style) footprint to match the approved connectivity manufacturer, and be made by the same manufacturer as the connectors.
      b. Match colors and materials of the power wiring device plates.
      c. Support any connectivity media type, including fiber and copper applications.
      d. Have write-on designation labels for circuit identification together with a clear plastic cover.
      e. Be available in single-gang and double-gang configurations.
      f. Have surface-mount boxes and standoff rings available for both single and double gang faceplates.
      g. Have single-port matching color blank inserts available in packs of 10.
      h. Shall be stainless steel when installed above accessible ceiling.
      i. Approved Products:
1) Leviton QuickPort Single-Gang, Plain, # 41080-#xp  
2) Leviton QuickPort Single-Gang with ID Windows, # 42080-#xS  
3) Leviton QuickPort Blank Inserts, pack of 10, # 41084-BxB  
4) Leviton QuickPort Stainless Steel wall phone plate, # 4108W-0SP  
5) Leviton Furniture Faceplate, 4-port, 49910-Ex4  
Where:  
# = number of ports: 1, 2, 3, 4, 6  
x = color: White (W), Ivory (I), Light Almond (T), Gray (G), Black (E)

B. SURFACE-MOUNT BLOCKS (SMB)
1. Surface-Mount Blocks (SMBs) are used to protect terminated CAT6A cables at the endpoints where they are not contained within walls or furniture. Example locations may be Wireless Access Points (WAPs), Group Work Areas fed by conduits run down columns, security cameras, or other network-enabled device locations.
2. Ceiling, WAP, Camera and other non-wall-mount locations will use a 2-port plastic SMB.
3. Small Surface-Mount Boxes shall exhibit the following characteristics:
4. Outlet housings for WAPs and other devices shall be a high-density, low profile design with (2) or (4) field-configurable ports, snap-lock cover, and cable knockouts on back.
5. Housing cover shall have raceway knockouts for top and bottom entry. Base shall include Tie-wrap anchor points at all cable entrances.
6. The housing shall be mountable with screws, tape or a single magnet.
7. The cover shall provide the option of securing it to the base with a screw that is hidden under the outlet identification window.
8. Shall be constructed of a Plenum-rated, high-impact self-extinguishing plastic rated UL 94V-0, and be UL Listed and compliant with FCC Part 68 and TIA-568 specifications.
9. Approved Products:
   a. Leviton QuickPort 2-port Surface-mount Housing, White, #41089-2WP

2.10 CABLE SUPPORTS

A. J-HOOKS
1. Support all cable above ceiling on dedicated cable support hardware a minimum of 6” above accessible ceilings.
2. Provide cable saddles and J-hooks where cable tray or wire basket is not available. These must be supported on their own ceiling wires, threaded rod, or affixed to building structure by use of beam clamps (on metal beams) or wood screws (on wood beams). Affixing communication cable supports to existing ceiling support wires is not allowed.
3. Approved Products:
   a. B-Line Cable Hook, BCHxx  
   b. B-Line Cable Hook, Cable to Beam Fastener, BCHxx-C2  
   c. B-Line Cable Hook, Cable to Fastener, 2”, BCHxx-C442  
   d. B-Line Cable Hook, Cable to Rod Fastener, 2”, BCHxx-W2  
   Where:  
   xx = 21 (1.25”), 32 (2”), or 64 (4”)

A. JACK/OUTLET BRACKETS
1. Above-ceiling cable termination locations shall be either wall-mounted or suspended from structure above the drop ceiling. Cables or terminations shall not rest on ceiling grid or equipment above ceiling grid.
2. For Wireless Access Points and other above-ceiling-mounted communications devices, cables shall land in an above-ceiling bracket which is affixed to dedicated cable support hardware.

3. Two category-rated jacks may be installed in each above-ceiling bracket. Each above-ceiling bracket will hold a 2-port Surface-Mount Box or 1-U MOS SMB for multimedia applications.

4. For wall-mounted device locations (above or below ceiling), devices needing to be mounted directly to a backbox will utilize the in-wall mounting bracket to secure the jack inside the backbox.

5. One category-rated jack can be installed in each in-wall backbox jack mounting bracket. For devices requiring (2) category-rated jacks, (2) in-wall brackets must be used.

6. Approved Products:
   a. Leviton QuickPort In-Ceiling Bracket, rod/wire hanger, 49223-CBC
   b. Leviton QuickPort In-Ceiling Bracket, accepts beam and screw mounts, 49223-CB0
   c. Leviton QuickPort In-Wall Bracket, 49223-BA5 (pack of 5)

2.11 APPROVED PRODUCTS

A. Approved Copper Connectivity Manufacturer Basis of Design
   1. Leviton Network Solutions

2.12 COPPER CONNECTIVITY

A. Category 6A Field Installable Modular Plug:
   1. The universal plug shall meet or exceed all performance requirements for Category 6A as described in ANSI/TIA-568.2-D, as well as Class EA requirements as described in ISO/IEC 11801-1.
   2. The plug shall comply with all National Electrical Codes, be compliant with ANSI/TIA-1096-A, and be UL listed.
   3. The plug shall meet all requirements of IEC 60603-7 (including IEC 60512-5-2) and IEC 60512-99-001 (including IEC 60512-9-3) standards.
   4. The plug shall be compliant with UL 2043 for use in air handling spaces
   5. The plug shall be encased in a 360° die-cast housing to protect it from potential EMI/RFI.
   6. The plug shall not require a specialized termination tool.
   7. The plug wiring shall accommodate T568 A/B wiring schemes.
   8. The plug shall accommodate 26-22 AWG solid or stranded conductors.
   9. The plug may be used to terminate to horizontal cable when connecting to Ethernet devices placed in fixed locations as recognized in ANSI/TIA-568.2-D Annex F- Modular Plug Terminated Link (MPTL), ANSI/TIA-862-B Annex C- Direct Connections, and ISO 11801-6 Type B generic cabling.
   10. The connector module shall support the following POE standards
       a. IEEE 802.3at (Type 1) Power over Ethernet (PoE) applications up to 15.4 watts
       b. IEEE 802.3at (Type 2) Power over Ethernet (PoE+) applications up to 30 watts,
       c. IEEE Draft 802.3bt draft (Type 3) Power over Ethernet (PoE+) applications up to 60 watts
       d. IEEE Draft 802.3bt draft (Type 4) Power over Ethernet (PoE+) applications up to 100 watts
       e. Cisco Universal Power Over Ethernet (UPOE) applications up to 60 watts
       f. Power over HDBaseTTM (POH) applications up to 100 watts
   11. Manufacturer: Leviton Cat 6A Universal Tool-Free Plug
PART 3 - EXECUTION

3.01 INSTALLATION

A. Refer to section 27 00 00

B. All installation shall be done in conformance with TIA-568 standards, BICSI methods, industry standards and manufacturer's installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines shall require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

C. Cabling between communications rooms and workstation locations are to be installed as individual “home runs”. No intermediate punch down blocks or splices may be installed or utilized between the communications rooms and the information outlets at the workstation location.

D. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than .5 inches of unsheathed Category 5e or 6 UTP cable at either the wiring closet or the workstation termination locations.

E. All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair equipment's efficient use of their full capacity.

F. EMT or Conduit for pathways shall have no more than two 90 degree bends and no continuous section over 100’. Each conduit opening will be fitted with a nylon bushing to prevent damage to cables.

1. Add hinged pull boxes to meet this requirements

G. Exposed Cable

1. All station cabling shall be installed inside walls or ceiling spaces whenever possible.
2. Exposed station cable will only be run where indicated on the drawings and will only be allowed when no other options exist. Owner must approve all exceptions.

H. Wireless Access Point Cable Requirements

1. The Contractor shall:
   a. Install horizontal cable from dedicated wireless patch panel(s) in telecommunications room terminated with a modular jack on the WAP location (wired to project standard).
   b. All WAP locations and cables shall be accessible by use of a 6’ ladder.

I. Coordinate with other trades on whether there is a presence of variable frequency drive motors (VFD) being used above ceilings or at any location in the building, and if so, where their locations are.

1. Route cabling away from VFD motors, maintaining a minimum of 6 feet from the motors.
J. Special Circuits
1. The Contractor shall coordinate with the Owner on the cable termination plan for special circuits (cables to wireless access point locations, IP security cameras, emergency analog telephone lines (elevators, fire alarms, etc.), service provider special circuits, security circuits, etc.).
   a. IP security cameras shall be terminated with an 8P8C modular jack at the device end.
   b. WAP jack placed in standard box and plate above ceiling.
   c. Security Camera jacks shall be the surface mount ‘biscuit’ type. Place biscuit jack in 5 square box at locations or use in-box bracket as specified in project documents and/or as indicated on drawings.
   d. Location and termination field description
      1) Room location
      2) Rack-mount or wall mount
      3) Termination field type
2. 110-type blocks
   a. Unique identifiers
      1) Segregation and position on equipment rack
      2) Port color-coding
      3) Unique labeling
3. The Contractor shall provide a copy of the finalized plan in writing to the Owner’s representative for review and authorization to proceed.

K. All cabling placed above drop ceilings must be supported by cable tray, conduit, or J-Hooks.
1. Permanently affix cable supports to the building structure or substrates and provide attachment hardware and anchors designed for the structure to which attached and are suitably sized to sustain the weight of the cables to be supported.
2. Attaching cable to pipes or other mechanical items is not permitted.
3. Communication cables shall be routed so as to provide a minimum of 18 inches spacing whenever possible from light fixtures, sources of heat and EMI sources.
4. Cabling shall not be attached to ceiling grid wires. Multiple cables are to be dressed every 5 feet to 7 feet.
5. Maximum cable sag between cable hooks is 3”-6”.

L. Provide shall provide a 3-foot service loop above the access ceiling or cable trays unless specified otherwise. All service loops shall be a minimum of 18 inches in diameter and be accessible for maintenance.
1. Coordinate loop placement and orientation with the technology consultant. This allows for future changes or expansion without installing new cables.

M. Install cabling in cable trays and J-hooks by function and type of circuit.
1. Loosely lay cable in trays, segregating cable types. Do not use Velcro or cable ties to bundle cables.
2. Install cables that are likely to induce current in UTP cables (such as speaker wiring) in a segregated manner, such as bridal rings on the side of a tray, or separate J-Hook support.

N. Maximum allowable temperature rise above ambient temperature is 55 degrees F.
1. Reduce cable bundle sizes and separate bundles to mitigate cable bundle temperature rise to a max of 55 delta from ambient.
2. Maximum allowable cable bundle internal temperature is 130 degrees F. Provide mitigation if allowable temperatures are exceeded.

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3. When bundling cables place non-PoE cables at the center of bundles and PoE cables on the exterior or outer layers of the bundles.

O. Identification:
1. Label cable terminations on designation strips.
2. Label all cable at each terminating point.
3. Label each port of the work area outlet.
4. Cable identification numbers shall not be duplicated.
5. Labeling convention to be coordinated with Owner.
6. Label data patch panels and voice blocks in the communications rooms to match those on the corresponding voice and data outlets. The font shall be at least .125-inch in height.
7. Where a wireless access point is installed above an acoustical ceiling, label the ceiling grid frame below the access point, displaying the data port number and, if applicable, the access point identification number. Coordinate with the Owner for all access point identification information.
8. All labels shall correspond to as-built drawings and to final test reports.
9. Coordinate with Owner for specifications on labeling of all hardware, cabling, and related equipment prior to any testing.
10. Label each distribution rack, block and other terminating equipment unit and field within that unit within 4 inches from the block or patch panel termination. Keep labels in a neat and orderly lineup.
11. Label each connector and each discrete unit of cable-terminating and connecting hardware within connector fields, in wiring closets and equipment rooms. Where similar jacks and plugs are used for both communication and data-processing equipment, use a different color for jacks and plugs of each service.
12. Post the cable schedule in a prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations.
13. Provide electronic copy of final comprehensive schedules for project in software and format selected by Owner.
14. Refer to the following drawing for faceplate labeling:
15. All cable labels shall:
   a. Be marked at each end, on the sheath indicating the Telecommunications Room and jack number to which the cable is wired.
   b. Backbone cables shall be marked at each endpoint and at all intermediate pull/ access points or junction boxes. Label shall indicate origination and destination Telecommunication Rooms, sheath ID and strand or pair range.
   c. Meet the legibility, defacement, exposure and adhesion requirements of UL 969.
   d. Be pre-printed or laser printed type.
   e. Where used for cable marking, a label with a vinyl substrate and white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable shall be provided. The label color shall be different than that of the cable to which it is attached.
   f. Where insert type labels are used, provide clear plastic covers to go over label.
   g. The Contractor shall confirm specific labeling requirements with the Owner or Owner’s Representative prior to cable installation or termination.

P. Documentation:
1. All cable inventory data documentation shall be submitted in format coordinated with and approved by Owner so that data can be incorporated into existing databases.
2. Documentation shall include cable identification number, source and destination, type of cable, length of cable and number of pairs or fibers.
3. Complete cross connect documentation is required. It shall include detailed documentation of each pair of all copper backbone cable and strand of fiber.

3.02 CLEANING

A. All surfaces, cabling, and hardware shall be kept clean and free of dust and debris.
B. Clean as needed and protect as required to maintain this requirement.

3.03 ACCEPTANCE

A. Once all work has been completed, test documentation has been submitted and approved, and the Owner is satisfied that all work has been completed in accordance with contract documents, the Owner will notify Contractor in writing of formal acceptance of the system.
B. Contractor’s RCDD shall warrant in writing that 100% of the installation meets the requirements specified herein.

3.04 FIELD QUALITY CONTROL

REFER TO SECTION 27 00 00

END OF SECTION
SECTION 27 1600

COMMUNICATIONS CONNECTING CORDS, DEVICES AND ADAPTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for connecting cords, devices and adaptors, supplementing requirements found in the related sections.

B. Related Sections
   1. 270000: Communications
   2. 270526: Grounding and Bonding of Communication Systems
   3. 270810: Optical Fiber Testing and Measurement
   4. 270820: Copper Testing
   5. 271100: Communications Equipment Room Fittings
   6. 271300: Communications Backbone Cabling
   7. 271500: Communications Horizontal Cabling

1.2 WORK INCLUDED

A. The Work of this Section shall consist of the labor, materials and equipment required for furnishing and installing telecommunications patch cables and equipment cords as part of a complete and functional telecommunications system.

B. All items specified or included in this section shall be furnished and installed by Telecommunications Contractor, wired and connected by Telecommunications Contractor and tested by Telecommunications Contractor, unless noted otherwise. “Contractor” as used herein shall mean Telecommunications Contractor or Telecommunications Contractor’s sub-contractor.

C. Communications Patch Cords, Station Cords, and Cross-Connect Wire
   1. Data cable assemblies for the horizontal cross-connect and the workstation shall match horizontal, patch panel, and jack Category.
   2. Data cable assemblies shall be factory-assembled by the manufacturer of the cabling system.
   3. Provide data backbone factory-terminated fiber optic cable assemblies (Duplex LC to LC duplex) using duplex XG 850nm laser-optimized 50/125µm and Single-mode cable cross-connect assemblies in equipment rooms.
   4. Provide patch cord quantities on shop drawings.

1.3 COORDINATION

A. Furnish and install the following:
   1. Patch and Equipment cords, for both copper and fiber.

B. Electrical Contractor shall furnish and install the following:
   1. Floor boxes, box covers, straps.
   2. Boxes above ceilings and box covers.

C. Unless noted, the following items will be the responsibility of the Owner:
1. All electronics and active data networking equipment, etc.
2. Telephones, fax machines and modems, etc.
3. PC’s, printers, video display terminals, flat panel displays, etc.

D. Contact the Owner’s network and computer equipment personnel for specific instructions before starting Work.

PART 2 - PRODUCTS

2.1 COPPER PATCH & EQUIPMENT CORDS

A. Patch cables and equipment cords shall be factory pre-connectorized, TIA/EIA compliant matching horizontal cable specifications, 4 pair UTP, 8-position modular jack, and stranded conductors. Patch cables and equipment cords shall be able to withstand at least a minimum of 200 jack mating cycles without any transmission degradation.

B. Provide all cords the same Category rating as cable, jacks and patch panels installed.

C. Provide patch cable lengths as coordinated with Owner. For bidding purposes assume 50% for 2M, and 25% for 1M, & 3M lengths.

D. Patch Cables For Equipment Rooms:
   1. Provide one UTP patch cable for each horizontal cable terminated on patch panels.
   2. Coordinate patch cable lengths and color with the Owner prior to ordering.
   3. Provide fifteen (15%) spare patch cables for each cable provided.

E. Provide equipment cords as follows:
   1. Provide one 10-foot (3 m) Category equipment cord for each data connector installed in data Work Area Outlets.
   2. Coordinate equipment cord lengths and color with the Owner prior to ordering. Minimum length: 10’.
   3. Provide fifteen (15%) spare equipment cords for each cable provided.
   4. Cords are to be new and factory terminated, delivered in original unopened packages.

F. Connection Reliability
   1. Use connectors with 50 μm gold-plated tines (as specified by TIA standards), as well as designs that distance the connection point between the connector tines and plug from the arcing damage.
   2. Connectors should also meet contact resistance requirements found in the IEC 60512-99-001 standard covering connectors for electronic equipment.

G. Manufacturer – Match approved manufacturer’s solution

2.2 FIBER OPTIC PATCH CORDS

A. Provide Fiber Optic Patch Cords to the existing telecommunications system as required for newly added data network cables. Verify existing conditions and requirements from District IT prior to purchase of patch cords.

B. Patch cables and equipment cords shall be factory pre-connectorized, TIA/EIA compliant.

C. Manufacturer: CommScope, or approved equal.
1. Provide one duplex fiber patch cable per two terminated fibers.
2. Connectors:
3. Lengths: 2 meters. Verify with Owner prior to purchase

D. Confirm connector types with Owner prior to purchase.
1. Provide the following multi-mode Core Style/Polish Type:
   a. [50/125 laser optimized cords to match installed backbone and riser fiber]
2. Provide the following Single-mode Core Style/Polish Type:
   a. [UPC Polish]
   b. [APC Polish]
3. Provide the following Cable Type:
   a. Duplex Plenum
4. Provide the following Hybrid Connector Combinations:
   a. [SC to LC]
5. Provide the following Standard and Pigtail Connector Combinations:
   a. [LC to LC]
6. Provide the following Mode Type:
   a. Single-mode
   b. Multi-mode
7. Provide the following Cable Lengths Quantity mix TBD:
   a. [(1m) = 3.3’]
   b. [(2m) = 6.6’]
   c. [(3m) = 9.8’]

PART 3 - EXECUTION

3.1 ADDITIONAL INFORMATION
A. Refer to Section 27 00 00 for submittal and other general requirements

3.2 INSTALLATION
A. Patch cords shall be delivered to the Owner in factory sealed packages.
1. Coordinate on delivery timing with GC and Owner to ensure any circuits required for permit or occupancy certificates will be active and connected on time.

B. Install all patch cords in accordance with the Owners I.T. Department or the person in charge of the telecommunications infrastructure.
1. After discussion with Owner, provide matrix of patching from port to switch port.

C. Bend radius of cables shall be maintained as recommended by the manufacturer and per BICSI standards.

END OF SECTION
SECTION 28 00 00

BASIC SECURITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes general administrative and procedural requirements for Division 28 and is intended to supplement, not supersede, the requirements specified in Division 1.

B. The requirements described herein include the following:
   1. References
   2. Definitions
   3. System Description
   4. Submittals
   5. Quality Assurance
   6. Project Management and Coordination Services
   7. Product Delivery, Storage, and Handling
   8. Warranty
   9. Maintenance

C. Products furnished and installed under another section:
   1. 120V power
   2. Conduit and junction boxes
   3. Door hardware
   4. Network Connections

D. Related Sections:
   1. Consult other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation.
   2. Section 28 05 13 – Security System Cabling
   3. Section 28 05 53 – Security System Labeling
   4. Section 28 08 00 – Security System Acceptance Testing
   5. Section 28 13 00 – Access Control and Alarm Monitoring System
   6. Section 28 16 00 – Intrusion Detection System
   7. Section 28 23 00 – Video Surveillance System
   8. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, and bollard foundations.
9. Selective Demolition: Nondestructive removal of materials and equipment for reuse or salvage as indicated. Also dismantling electrical materials and equipment made obsolete by these installations.

10. Concrete Work: Include forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting as required for underground conduit encasement, pedestal foundations, and curbs (also includes saw-cutting of existing slabs and grouting of conduits in saw-cut).

11. Miscellaneous Metal Work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, equipment enclosures, cameras, and similar devices.

12. Miscellaneous Lumber and Framing Work: Include wood grounds, nailers, blocking, fasteners, and anchorage for support of security materials and equipment.

13. Moisture Protection and Smoke Barrier Penetrations: Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls. Tape and make vapor tight penetrations through vapor barriers at slabs on grade.

14. Locking Hardware: Include interface to electronic hardware and door controllers on security related doors.

15. Access Panels and Doors: Required in walls, ceilings, and floors to provide access to security devices and equipment.

16. Painting: Include surface preparation, priming and finish coating as required for security cabinets, exposed conduit, pull and junction boxes, and devices where indicated as field painted in this Division. Refer to Division 9, Painting.

17. Elevators: Include interface to elevator floor and hall call on security related elevators.

1.02 REFERENCES

A. General

1. Codes, standards, and industry manuals/guidelines listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Consider such codes and/or standards a part of this Specification as though fully repeated herein.

2. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

3. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid unless otherwise specifically stated.
B. Codes: Perform Work executed under this Section in accordance with applicable requirements of the latest edition of governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:

1. California Code of Regulations (CCR):
   a. Title 8, “Industrial Relations”
      1) Chapter 3.22, “California Occupational Safety And Health Regulations (CAL/OSHA)”
   b. Title 24, “California Building Standards Code”
      2) Part 2, Volumes 1 and 2, “California Building Code” (CBC)
      3) Part 3, “California Electrical Code” (CEC)
      4) Part 11, “California Green Building Standards Code” (CALGeen)”

2. National Fire Protection Agency (NFPA)
   a. NFPA 70, “National Electrical Code” (NEC)
   b. NFPA 75, “Protection Of Information Technology Equipment”

3. National Fire Protection Agency (NFPA)
   a. NFPA 70, “National Electrical Code” (NEC)
   b. NFPA 75, “Protection of Information Technology Equipment”

4. International Code Council

5. National, State, Local and other binding building and fire codes

   a. Part 15, Radio Frequency Devices

C. Standards: Perform Work and furnish materials and equipment under Division 137xx in accordance with the latest editions of the following standards as applicable:

   a. UL 294: Access Control System Units
   b. UL 1076: Proprietary Burglar Alarm Units and Systems
   c. UL 2044 Commercial Closed-Circuit Television Equipment
1.03 DEFINITIONS

A. The Definitions of Division 1 apply to the 28xxxx sections

B. In addition to those Definitions of Division 1, the following list of terms as used in this specification defined as follows:

1. “Owner”: Contra Costa Community College District
2. “Engineer”: TEECOM Design Group
3. “Furnish”: To purchase, procure, acquire, and deliver complete with related accessories.
4. “Install”: To set in place, join, unite, fasten, link, attach, set up or otherwise connect together and test before turning over to the Owner, parts, items, or equipment supplied by contractor or others. Complete installation and make ready for regular operation.
5. “Provide”: To furnish, transport, install, erect, connect, test and turn over to the Owner, complete and ready for regular operation.
6. “Connect”: To install required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
7. “As directed”: As directed or instructed by the Owner, or their authorized representative.
8. “Cabling”: A combination of cables, wire, cords, and connecting hardware (e.g., cables, conductor terminations, connectors, outlets, patch panels, blocks, and labeling).
9. “System”: The access control, video surveillance, and intrusion detection systems
11. “SJB”: Security Junction Box
12. “ACAMS”: Access Control & Alarm Monitoring System
13. “VSS”: Video Surveillance System
14. “IDS”: Intrusion Detection System

1.04 SYSTEM DESCRIPTION

A. Overview

1. The Owner intends to renovate a multi-level building at Diablo Valley College.
2. Security at the new facility will consist of video surveillance, access control and alarm monitoring, and intrusion detection systems.
3. The System will connect to the Owner’s existing Software House CCure 9000 headend located at the District Office over the Owner’s local/wide area network.
4. Provide a high level of coordination services to ensure the proper installation and functioning of the security system.
5. Coordinate the installation of the security system with other trades. This may include: review of other’s subcontractor’s shop drawings, attendance at meetings, providing samples for mockup, and preparation & distribution of written documentation.

6. Refer to Division 1 for detail building description.

B. Existing Conditions

1. Perform a functional test of the existing security devices and provide a written list to the Owner and Engineer of deficiencies prior to the commencement of work. Security work not identified assumed as functional and contractor will repair at no additional cost to the Owner.

C. Base Bid Work

1. Access Control and Alarm Monitoring System (ACAMS)
   a. The Owner requires an access control system to automate opening and closing of the building, restrict access after hours by cardholder privileges, and monitor specific spaces for intrusion.
   b. The ACAMS consists of card readers, control panels, power supplies, workstations, alarm monitoring devices, and interfaces to other security equipment.
   c. Refer to Section 28 13 00 for detailed description of system.

2. Intrusion Detection System (IDS)
   a. The IDS consists of keypads, control panels, duress buttons, alarm monitoring devices, and interfaces to other security equipment.
   b. The IDS will communicate with a remote, third-party central station for alarm monitoring and contact Police Services during day-time operation and dispatch of the local Police Department after hours.
   c. Refer to Section 28 16 00 for detailed description of system.

3. Video Surveillance System (VSS)
   a. The Owner requires a video surveillance to provide a photographic record of access control transactions and alarm events, some real-time monitoring of the facility, and integration with the access control and alarm monitoring system.
   b. The VSS consists of a combination of analog and IP cameras, power supplies, IP encoders, and network video recorders.
   c. Refer to Section 28 23 00 for detailed description of system.

4. The System includes integration with the Fire/Life-Safety system to provide the following:
a. Automatically release locks upon fire alarm activation for doors within the path of egress
b. Disconnect power to magnetic door holders to automatically close doors after business hours

1.05 SUBMITTALS

A. Submit required submittals to the General Contractor in the quantities and formats as required under the general contract. In the absence of requirements, provide as described in the following with reference to quantity and format.

B. Contractor Qualifications

1. Resumes of the Project Manager, General Foreman, and Lead Technician(s) indicating role, years of experience, product certifications and training, listing of similar projects the individual performed the role proposed for this project along with client contact information for each.

2. Certification letters stating the Contractor is an authorized reseller, installer, and extended warranty provider for the following systems:
   a. Software House CCure 9000
   b. Salient Systems

C. Product Data

1. Obtain written approval from the Engineer for the product data submittal prior to the release of materials and equipment purchase order and prior to installation.

2. Quantity: Submit product data submittals as described in Division 1.

3. Format:
   a. Minimum Format: Submit each product data submittal in an 8-1/2 x 11 inch folder. Product data submittal shall be in a 3-ring binder (or similar). If in a 3-ring binder, insert the submittal information the transparent front cover and spine pockets.
   b. Clearly label the cover and spine of each submittal with the following information:
      1) Client Name
      2) Project Name and Address
      3) Project Submittal Number
      4) Submittal Name (e.g., “Product Data Submittal for Video Surveillance System”)
      5) Specification Section Number (e.g., “Section 28 23 00”)
      6) Date of Submittal Format: <month> <day>, <year> (e.g., “January 1, 2010”)
      7) Contractor Name
   c. Include a Table of Contents at the beginning of the submittal that lists materials by article and paragraph number (e.g., “2.02-A Network Video Recorders”).
   d. Include tabbed separators for improved navigation through the submittal.
4. Content:
   a. Cover Letter: Product data submittals shall include a cover letter stating that the submittal is in full compliance with the requirements of the Contract Documents. Sign (and stamped, if applicable) cover letter and list items and data submitted. Have the person who prepared the submittal sign the document as well. Failure to comply with this requirement shall constitute grounds for rejection of submittal.
   b. Product Information: Product Data submittal shall consist of manufacturer's technical data, product literature, "catalog cuts", data sheets, specifications, and block wiring diagrams (if necessary). This data shall clearly describe the product's characteristics, physical and dimensional information, electrical performance data, materials used in fabrication, material color & finish, and other relevant information such as test data, typical usage examples, independent test agency information, and storage requirements. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories, which are included and those which are excluded. At a minimum, include products listed in the Division 28 specifications. Include relevant products that will be installed, which are not listed in the specifications.
   c. Re-submittals: Provide a cover letter with the re-submittal that lists the action taken and revisions made to each product submittal in response to Submittal Review Comments. No review shall take place for any re-submittal packages that is not accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the re-submittal package.

D. Shop Drawings
   1. Obtain written approval from the Engineer for the shop-drawings submittal prior to the release of materials and equipment purchase order and prior to installation.
   2. Quantity and Media: Submit shop-drawings as described in Division 1.
   3. Format:
      a. Produce shop drawings using AutoCAD, or other computer design application that can save files to AutoCAD-compatible files.
      b. Use the same size drawing sheet as the drawings of the Contract Documents.
      c. Text: minimum of 3/32” high when plotted at full size.
      d. Screen background information.
      e. Plot system components (devices, cable routes, etc.) and text at a sufficient line weight to stand out against background information.
      f. Scaling:
         1) Scale floor plans at 1/8”=1’-0”
         2) Scale enlarged room plans at 1/4”=1’-0”
         3) Scale wall elevations at 1”=1’-0”
a. Submit shop drawings that represent proposed installation of security system.

b. Floor Plans: Scale floor plans at 1/8"=1'-0". Floor plans shall show:
   1) Locations and identifiers of security devices.
   2) Size, quantity, location and proposed routes of security cabling.
   3) Size, quantity, location, and routes of pathways (such as cable trays, cable basket, conduits, cable hangers, and other cable support devices).

c. Point-to-Point Diagrams: Include wiring, points of connection and interconnecting devices.

d. Schedules: Provide schedules for devices and control panels that show each point ID with a description of the connected devices.

e. Block Diagram/Riser Diagram: Show the devices, conduit, wire types, and sizes between them, including cabling interties between termination hardware.

f. Proposed mounting details

E. As-Built Drawings

1. Quantity and Media: Submit as-built drawings as described in Division 1 in both hard copy and electronic formats.

2. Format:
   a. Produce as-built drawings using AutoCAD, or other computer design application that can save files to AutoCAD-compatible files.
   b. Use the sheet size as the drawings of the Contract Documents, and use the project title block.
   c. Text: minimum of 3/32” high when plotted at full size.
   d. Use symbols identical to the symbols shown on the Drawings.
   e. Screen background information.
   f. Plot system components (devices, cable routes, etc.) and text at a sufficient line weight to stand out against background information.

3. Content:
   a. Submit as-built drawings that fully represent actual installed conditions and that incorporate modifications made during the course of construction.
   b. Floor Plans: Scale floor plans at 1/8"=1'-0". Floor plans shall show:
      1) Locations and identifiers of security devices.
      2) Size, quantity, location and proposed routes of security cabling.
      3) Size, quantity, location, and routes of pathways (such as cable trays, cable basket, conduits, cable hangers, and other cable support devices).
   c. Point-to-Point Diagrams: Include wiring, points of connection and interconnecting devices.
d. Schedules: Provide schedules for devices and control panels that show each point ID with a description of the connected devices.

e. Block Diagram/Riser Diagram: Show the devices, conduit, wire types, and sizes between them, including cabling interties between termination hardware.

f. Custom mounting details

F. Operation and Maintenance (O&M) Manuals

1. Quantity: Submit quantity of O&M Manuals as described in Division 1 in both hard copy and electronic formats.

2. Format:
   a. Submit each O & M Manual in a white, 3-ring binder with front cover and spine clear pockets for insertion of the project information.
   b. Clearly label the cover of each O&M Manual with the following information:
      1) Client Name
      2) Project Name and Address
      3) Manual Name (e.g., “Operation and Maintenance Manual for Telecommunications Cabling System”)
      4) Date of Submittal Format: <month> <day>, <year> (e.g., “January 1, 2010”)
      5) Contractor Name
   c. Include a Table of Contents at the beginning that lists the contents.
   d. Include tabbed separators for improved navigation through the manual.

3. Content:
   a. 11”x17” prints of as-built drawings, as described above
   b. Manufacturer's original catalog information sheets for each component provided under applicable Section (typically, this is similar to the accepted product data submittal)
   c. Warranty certificate from the manufacturer and the Contractor
   d. Manufacturer’s instructions for system or component use
   e. Instructions and requirements for maintenance and warranty issues

4. Contents shall include requirements and methods for maintaining installed products.

1.06 QUALITY ASSURANCE

A. General

1. Provide new and unused materials, equipment, and parts comprising the units specified herein of current manufacturer and of highest grade.

2. Only use products and applications listed in this Division on the project

B. Substitutions
1. Conform to the general requirements and procedure outlined in Division 1 in the Request For Substitution.

2. Where products are noted as "or equal", a product of equivalent design, construction, and performance is considered. Include in the Product Data submittal: catalog cuts, product information, and pertinent test data required to substantiate that the product is in fact equivalent to that specified.

3. Only one substitution allowed for each product specified. Do not provide substituted material, processes, or equipment without written authorization from the Engineer. Assumptions on the acceptability of a proposed substitution, prior to acceptance by the Engineer, are at the sole risk of the Contractor.

4. The burden of proof rest with the Contractor that the substituted product is equivalent to the specified product. When the Engineer accepts a substitution in writing, it is with the understanding that the Contractor guarantees the substituted product, component, article, or material to be equivalent to the one specified and dimensioned to fit within the construction according to contract documents. Approved substitutions do not relieve the Contractor of responsibilities for the proper execution of the Work, or from provisions of the Specifications.

5. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility and appearance. Materials, processes or equipment that, in the opinion of the Engineer, are equivalent in quality, utility and appearance will be approved as substitutions to that specified when “or equal” follows the manufacturers' names or model number(s).

6. Whenever material, process or equipment is specified in accordance with a Federal specification, an ASTM standard, an ANSI specification, UL rating or other association standard, present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, submit support test data to substantiate compliance at no additional cost.

7. Pay expenses, without additional charge to the Owner, in connection with substitution materials, processes and equipment, including the effect of substitution on self, subcontractor's or other Contractor's work.

C. Contractor Qualifications

1. A current, active, and valid and C7 or C10 California State Contractors License

2. Minimum five years experience in installation and service of access control, video surveillance, and intrusion detection systems.

3. Minimum five completed projects similar to scope and cost.

4. Evidence of technicians qualified for the work in the form of current manufacturer’s training certification

D. Materials

1. Materials, support hardware, equipment, parts comprising units, etc., shall be new, unused, without defects and of current manufacturer, materials
2. Use specified products and applications, unless otherwise submitted and approved in writing.

E. Regulatory Requirements
1. Work and materials shall conform to the latest rules of National Board of Fire Underwriters wherever such standards have been established and shall conform to the regulations of the State Fire Marshal, OSHA and the codes of the governing local municipalities. Work under Division 28 shall conform to the most stringent of the applicable codes.

2. Provide the quality identified within these Specifications and Drawings when codes, standards, regulations, etc. allow Work of lesser quality or extent. The Contract Documents address the minimum requirements for construction.

F. Drawings
1. Follow the general layout shown on the Drawings except where other work may conflict with the Drawings.

2. Drawings for the Work within this Division are essentially diagrammatic within the constraints of the symbology applied.

3. The Drawings do not fully represent the entire installation for the security system. Drawings indicate the general route for the cables and the location of outlets. The Drawings might not expressly show every conduit, sleeve, hanger, etc., but a complete system is required.

4. Complete the details necessary for point-to-point design. This allows the Contractor to achieve desired results applying their own procedures and methods. Submit shop drawings for review prior to installation.

1.07 PROJECT MANAGEMENT AND COORDINATION SERVICES

A. Project Management and Coordination Services
1. Provide a project manager for the duration of the project to coordinate this Work with other trades. Coordination services, procedures and documentation responsibility include, but are not limited to, the items listed in this section.

2. Review of Shop Drawings Prepared by Other Subcontractors:
a. Obtain copies of shop drawings for equipment provided by others that require telecommunication service connections or interface with Work.
b. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 28 contract documents. Document discrepancies or deviations as follows:
   1) Prepare memo summarizing the discrepancy
   2) Submit a copy of the specific shop drawing, indicating via cloud, the discrepancy
c. Prepare and maintain a shop drawing review log indicating the following information:
   1) Shop drawing number and brief description of the system/material
   2) Date of the review
   3) Name of the individual performing the review
   4) Indication if follow-up coordination is required

3. Request for Information (RFI)
a. Thoroughly review the contract documents prior to the preparation and submission of an RFI. If an RFI is submitted, attach 8 1/2" x 11" copies of relevant documents to clarify the issue.
b. Submit RFIs with your recommended solution.
c. Prepare and maintain an RFI log using a Microsoft Excel spreadsheet indicating the following information:
   1) RFI number and brief summary of the issue.
   2) Date of issuance and receipt of response.

4. Scheduling of Work
a. Prepare work schedules for each floor or building indicating the following information:
   1) Cable Installation
   2) SEC Build Out
   3) Device Installation
   4) Programming
   5) Testing
   6) Other tasks included under the alternate work section of these specifications

B. Role of the Engineer
1. During the construction phase of the project, the Engineer will work with the Contractor to provide interpretation and clarification of project contract documents, reply to (and ‘process’) relevant Requests for Information (RFIs), and act as an interface between the Contractor and the Owner.
2. The Owner has retained the Engineer’s services to observe the Work for general compliance with the Contract Documents and to ensure that the installation meets the design intent of the system.
3. In general, the Engineer will participate during the construction phase as follows:
   a. Review product data and shop drawings submittals for general compliance with the contract drawings and specifications.
   b. Review changes as they arise, and confirm that the proposed solutions maintain the intended functionality of the system.
   c. Interpret field problems for Owner, and translate between Owner and Construction Team.
   d. Review the testing procedures to confirm compliance with industry-accepted practices.

C. Use of CAD Files
   1. Should the Contractor need the Engineer’s CAD files to produce shop drawings and/or as-built drawings, the Engineer requires the Contractor sign a CAD files release agreement.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery
   1. Do not deliver security system components to the site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable.
   2. Replace equipment damaged during shipping and return to manufacturer at no cost to the Owner.

B. Storage
   1. Store materials in a clean, dry, ventilated space free from temperature extremes.
   2. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic.
   3. Provide heat where required to prevent condensation or temperature related damage.

C. Handling
   1. Handle in accordance with manufacturer's written instructions.
   2. Prevent internal component damage, breakage, denting and scoring. Do not install damaged equipment. Replace damaged equipment and return equipment to manufacturer.

1.09 WARRANTY

A. Provide the Security System as described in this specification with a one-year parts and service warranty at no additional cost to the Owner.

B. Include in the warranty package, at a minimum, the following:
   1. Software support agreement for the ACAMS and VSS
   2. Software upgrades and patches
3. Labor to install software upgrades and patches necessary to maintain the latest version
4. Emergency service on regular working hour basis
5. Service by factory trained and employed service representatives of system manufacturer

C. Maintain regular service facilities and provide a qualified technician familiar with this work at the site within four (4) hours of receipt of a notice of malfunction including weekends and holidays. Provide material, devices equipment and personnel necessary for repairs. Install approved temporary, alternate equipment if required by the Owner, complete and operational within twenty four (24) hours after notification of a malfunction, at no additional cost.

D. Conduct warranty repairs and service at the job site unless in violation of manufacturer's warranty; in the latter event, provide substitute systems, equipment and/or devices, acceptable to the Owner, for the duration of such off-site repairs. Transport warranty substitute and/or test systems, equipment, devices, material, parts and personnel to and from the job site at no additional cost.

1.10 MAINTENANCE

A. Extra Materials
1. Deliver extra materials to a secured location determined by the Owner.
2. Provide a complete Bill of Materials listing quantities, part numbers, and descriptions for each device for the Owner to sign indicating receipt of equipment.
3. Provide new and unused spare parts in their original packing materials upon delivery.

B. Maintenance Service
1. For the first year of service, conduct quarterly system performance review meetings to review system operation problems and/or defects that occurred during the preceding 3 months. During these performance review meetings, perform the following:
   a. Visual checks and operational tests of the central processor, local processors, monitors, keyboards, system printers, peripheral equipment, ACAMS equipment, power supplies, and electrical and mechanical controls
   b. Clean system equipment, including interior and exterior surfaces
   c. Perform diagnostics on equipment
   d. Check and calibrate each device
   e. Run system software and correct diagnosed problems
   f. Resolve previous outstanding problems
2. Provide software and firmware updates issued free of charge by the manufacturer.
PART 2 - PRODUCTS

2.01 GENERAL

A. Material and equipment specified herein have been selected as the basis of acceptable quality and performance and have been coordinated to function as components of the included systems. Where a particular material, device, equipment or system is specified directly, the current manufacturer's specification for same is a part of these specifications, as if completely elaborated herein.

B. Remove manufacturer identification marks from visible equipment.

C. Use standard, regularly manufactured, materials and equipment for this and/or other similar systems, and not custom designed especially for this project. Provide systems and components thoroughly tested and proven in actual use. Provide subsystems of one manufacturer.

2.02 TAMPER RESISTANT HARDWARE

A. Provide pinned-allen type hardware for exposed hardware in public spaces.

1. Provide hardware used in specialty metal surfaces that posses a similar finish color.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Conditions: Verify existing conditions, which have been previously provided under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. Pathways: Verify that pathways and supporting devices, which have been previously provided under other sections, are properly installed, and that temporary supports and devices have been removed.

C. Field Measurements: Verify dimensions of pathways, including length of pathways. For example, “True Tape” the conduits to verify cable distances.

3.02 FIELD QUALITY CONTROL

A. Staffing: Provide a qualified foreman who is in charge of the Work and who is present at the job site at times Work is being performed. Perform the Work using skilled technicians under the direction of the foreman. Supervise the work force executing the Work. Perform the installation within the restraints of the construction schedule. Do not change the supervisor during the project without prior written approval from the Owner.

B. Inspection: Perform inspection after installation. Keep areas of work accessible and notify code authorities, or designated inspectors, of work completion released for inspection. Document completion, and inspection as required.

3.03 INSTALLATION
A. Perform this work in accordance with acknowledged industry and professional standards and practices and the procedures specified herein.

B. Provide a complete, operating system. Include devices specified including basic components and accessories, interconnecting wiring and other equipment and installation devices necessary for a complete system as specified.

C. Manufacturer's Instructions:
   1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
   2. Maintain jobsite file of Material Safety Data Sheets (MSDS) for each product delivered to jobsite.

D. Boxes, Panels, and Enclosures
   1. Install boxes, panels, and enclosures square and plumb.
   2. Set "flush mounted" units with the face of the cover, bezel or escutcheon in the same plane as the surrounding finished surface.
   3. Mount boxes, panels and trim so that there are no gaps, cracks or obvious lines between the trim and the adjacent finished surface and ready them to receive final finish, as applicable.
   4. Install insulating terminations in signal circuit boxes, panels, wireways or enclosures.

E. Painting
   1. Custom paint devices as indicated on the drawings.

3.04 REPAIR/RESTORATION

A. Replace or repair work completed by others that you deface or destroy, at no cost to the Owner.

B. Punch List:
   1. Inspect installed work in conjunction with the General Contractor and develop a punch list for items needing correction.
   2. Provide punch list to Engineer for review prior to performing punch walk with the Engineer.

C. Re-Installation:
   1. Make changes to the system such that defects in workmanship are correct and cables and the associated termination hardware passes the minimum test requirements.
   2. Repair defects prior to system acceptance.

D. Painting: Repaint surfaces altered during installation of the security system to match previous conditions.
3.05 CLEANING

A. Remove temporary coverings and protection of adjacent work areas. Remove unused products, debris, spills, or other excess materials. Remove installation equipment.

B. Leave finished work and adjacent surfaces in neat, clean condition with no evidence of damage.

C. Repair or replace damaged installed products.

D. Legally dispose of debris.

E. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

END OF SECTION
SECTION 28 00 01

ELECTRONIC SAFETY BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 28 00 01, Electronic Safety Basic Requirements applies to Division 28, Electronic Safety work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electronic safety systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:
   1. Provide: To furnish and install, complete and ready for intended use.
   2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
   3. Install: Includes unloading, unpacking, assembling, erecting, installing, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
   4. Or Equal: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Section 01330, Submittal Procedures, and approved by the Engineer prior to submitting bids for substituted items.
   5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities having jurisdiction, including local fire marshal, Owner's insurance underwriter, Owner's representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section apply to Division 28, Electronic Safety Contract Documents.

B. Related Work:
   1. Additional conditions apply to this Division including, but not limited to:
      a. Specifications
      b. Drawings
      c. Addenda
      d. Owner/Architect Agreement
      e. Owner/Contractor Agreement
      f. Codes, Standards, Public Ordinances and Permits

C. Contents of Division 26, Electrical apply to this Section.
1.3 REFERENCES AND STANDARDS

A. References and Standards per Section 01410, Regulatory Requirements, individual Division 28, Electronic Safety Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
   1. State of California:
      a. CBC - California Building Code
      b. CEC - California Electrical Code
      c. CEC T24 - California Energy Code Title 24
      d. CFC - California Fire Code
      e. CMC - California Mechanical Code
      f. CPC - California Plumbing Code
      g. CSFM - California State Fire Marshal

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
   1. ABA - Architectural Barriers Act
   2. ADA - Americans with Disabilities Act
   3. ANSI - American National Standards Institute
   4. ASCE - American Society of Civil Engineers
   5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
   6. ASHRAE Guideline 0, the Commissioning Process
   7. ASME - American Society of Mechanical Engineers
   8. ASTM - ASTM International
   9. CFR - Code of Federal Regulations
   10. EPA - Environmental Protection Agency
   11. ETL - Electrical Testing Laboratories
   12. FM - FM Global
   13. ISO - International Organization for Standardization
   14. NEC - National Electric Code
   15. NEMA - National Electrical Manufacturers Association
   16. NFPA - National Fire Protection Association
   17. OSHA - Occupational Safety and Health Administration
   18. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association
   19. UL - Underwriters Laboratories Inc.

D. See Division 28, Electronic Safety individual Sections for additional references.

E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract.

F. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
G. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

1.4 SUBMITTALS

A. See Section 01330, Submittal Procedures.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each Specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.

E. Product Data: Provide manufacturer's descriptive literature for products specified in Division 28, Electronic Safety Sections.

F. Identify/mark each submittal in detail. Note what difference, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.

1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference individual Division 28, Electronic Safety specification Sections for specific items required in product data submittl outside of these requirements.

3. See Division 28, Electronic Safety individual Sections for additional submittal requirements outside of these requirements.

G. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

H. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an
individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

I. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Structural documents.

J. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 28, Electronic Safety Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety submittals.

K. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

L. Substitutions and Variation from Basis of Design:
   1. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
   2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor are required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or equal," a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
   3. Where manufacturer equipment or model numbers are indicated with no exceptions, substitutions will be rejected.

M. Shop Drawings:
   1. Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 28, Electronic Safety specification Sections for additional requirements for shop drawings outside of these requirements.
   2. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

N. Samples: Provide samples when requested by individual Sections.

O. Resubmission Requirements:
   1. Make any corrections or change in submittals when required by Architect/Engineer review comments. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a
cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

2. Resubmit for review until review indicates no exception taken or "make corrections noted."

3. When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

P. Operation and Maintenance Manuals, Owners Instructions:

1. Reference individual Division 28, Electronic Safety Specification Sections for additional requirements for operations and maintenance manuals.

2. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
   a. Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
   b. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes and quantities relevant to each piece of equipment.
   c. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.
   d. Include Section 01740, Warranties/Guarantees, Section 28 00 01, Electronic Safety Basic Requirements and individual Sections.
   e. Include product certificates of warranties and guarantees.
   f. Include copy of start-up and test reports specific to each piece of equipment.
   g. Include commissioning reports.
   h. Engineer will return incomplete documentation without review.
   i. Engineer will provide one set of review comments in Submittal Review format. Arrange for additional reviews; Bear costs for additional reviews at Engineer's hourly rates.

3. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 28 00 01, Electronic Safety Basic Requirements Article titled "Demonstration."

4. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

Q. Record Drawings:

1. Maintain at site at least one set of drawings for recording “as-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements and location of concealed items. Include items changed by addenda, field orders, supplemental instructions, and constructed conditions.
2. Record Drawings are to include equipment locations, calculations, and schedules that accurately reflect "as constructed or installed" for project.

3. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.

4. See Division 28, Electronic Safety individual Sections for additional items to include in Record Drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials to conform to all local, State, Federal and other applicable laws and regulations.

B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (e.g. cable tray, panels, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

E. Provide products that are UL listed.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Section 01740, Warranties/Guaranties, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Section 01740, Warranties/Guaranties. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted,
including footings and foundation. Identify zone of influence from footings and ensure systems
are not routed within the zone of influence. Unless otherwise required by Section 01311,
Project Management and Coordination, and/or Division 28, Electronic Safety to combine
information furnished by other trades onto master coordination documents.

B. Prepare Drawings as follows:
1. Drawings in CAD Format. CAD format or Revit Model release equal to design
documents. Drawings to be same sheet size and scale as Contract Drawings and indicate
location, size and elevation above finished floor of equipment and distribution systems.
2. Review and revise, as necessary, section cuts in Contract Drawings after verification of
field conditions.
3. Indicate fittings, hangers, access panels, and elevation of bottom of cable tray above
finished floor.
4. Drawings to indicate proposed ceiling grid and lighting layout as shown on electrical
drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork.
5. Incorporate Addenda items and change orders.
6. Provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs
resulting from failure to properly coordinate installation or failure to advise Architect of
conflict.

D. Verify in field exact size, location, and clearances of existing material, equipment and
apparatus, and advise Architect of discrepancies between that indicated on Drawings and that
existing in field prior to installation related thereto.

E. Submit final Coordination Drawings with changes as Record Drawings at completion of
project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide like items from one manufacturer, including but not limited to panels, devices and
equipment unless otherwise specified in individual Division 28, Electronic Safety Sections.

2.2 MATERIALS

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used
for construction are to be new, latest products as listed in manufacturer's printed catalog data
and are to be UL or FM approved or have adequate approval or be acceptable by state, county,
and city authorities.

B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

C. Names and manufacturer's names denote character and quality of equipment desired and are
not to be construed as limiting competition.

D. Hazardous Materials:
1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
2. Comply with Section 01412, Hazardous Materials, for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A., Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

B. Install equipment having components requiring access (i.e., devices, equipment, electrical boxes, panels, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:
   1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:
      a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
      b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
      c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:
   1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:
      a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around conduit, raceway and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet

F. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Structural documents, and individual Division 28 Electronic Safety Sections.

B. Earthquake resistant designs for Electronic Safety (Division 28) systems and equipment to conform to regulations of jurisdiction having authority.

C. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

D. Provide means to prohibit excessive motion of safety equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Section 01400, Quality Control Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
   1. Underground conduit and wire installation prior to backfilling.
   2. Prior to covering walls when electronic safety systems installation is started.
   3. Prior to ceiling cover/installation.
   4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Comply with individual Division 28, Electronic Safety Sections and the following:
   1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
   2. Prior to changing over to new system, verify that every item is thoroughly prepared. Install new wiring to point of connection.
   3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference
to a minimum. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.

4. Organize work to minimize duration of power interruption.

3.5 **CUTTING AND PATCHING**

A. Confirm Cutting and Patching Requirements in Section 01730, Cutting and Patching, and individual Division 28, Electronic Safety Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, repair, refinish and leave in condition matching existing prior to commencement of work.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 **EQUIPMENT SELECTION AND SERVICEABILITY**

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 **DELIVERY, STORAGE AND HANDLING**

A. Confirm requirements in Section 00700, General Conditions. In absence of specific requirements, comply with the individual Division 28, Electronic Safety Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust.

2. Protect equipment and pipe to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3. Protect devices, panels and similar items until in service.

4. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
3.8 DEMONSTRATION
   A. Confirm Demonstration requirements in Section 01770, Contract Closeout Procedures, Articles 1.12, 1.13, and 1.14, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

   B. Upon completion of work and adjustment of equipment, test systems, demonstrate to Owner's Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Staff as specified in Section 01770, Contract Closeout Procedures, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

   C. Manufacturer's Field Services: Furnish services of a qualified factory certified instructor at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING
   A. Confirm cleaning requirements in Section 01710, Cleaning Requirements, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28 Sections.

   B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION
   A. Confirm Installation requirements in Section 01311, Project Management and Coordination, Article 1.8.A, Section 28 00 01, Electronic Safety Basic Requirements and individual Division 28, Electronic Safety Sections.

   B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to building structure. Maintain manufacturer's recommended clearances.

   C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

   D. Provide miscellaneous supports required for installation of equipment, conduit and wiring.

3.11 PAINTING
   A. Confirm Painting requirements in Division 09, Finishes. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:
      1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e. hangers, hanger rods, equipment stands, with
one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.

2. In electrical and mechanical room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

3. See individual equipment Specifications for other painting.

4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

5. Conduit: Clean, primer coat and paint interior conduit exposed in finished areas with two coats paint suitable for metallic surfaces. Color selected by Architect.

### 3.12 DEMOLITION

A. Confirm requirements in Section 01010, Summary of Work. In the absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:

1. **Scope:**
   a. It is the intent of these documents to provide necessary information and adjustments to electronic safety system required to meet code, and accommodate installation of new work.
   b. **Existing Conditions:** Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve underground utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.
   c. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access, access to different areas. Owner will cooperate to best of their ability to assist in coordinated schedule, but will remain final authority as to time of work permitted.

2. **Examination:**
   a. Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to locate and preserve utilities. Replace damaged items with new material to match existing.
   b. Verify that abandoned wiring and equipment serve only abandoned facilities.
   c. Demolition drawings are based on casual field observation and existing record documents.
      1) Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish work.
      2) Verify location and number of electronic safety system devices, panels, etc. in field.
   d. Report discrepancies to Architect before disturbing existing installation.

3. Promptly notify Owner if systems are found which are not shown on Drawings.

4. **Execution:**
   a. Remove existing electronic safety equipment, devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.
   b. Provide temporary wiring and connections to maintain electrical continuity of existing systems during construction. Remove or relocate electrical boxes, conduit,
wiring and equipment as encountered in removed or remodeled areas in existing construction affected by this work.

c. Remove and restore wiring which serves usable existing outlets clear of construction or demolition.
d. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, provide new conduit and wire to bypass abandoned outlets.
e. If existing conduits pass through partitions or ceiling which are being removed or remodeled, provide new conduit and wire to reroute clear of construction or demolition and maintain service to existing load.
f. Extend circuiting and devices in existing walls to be furred out.
g. Remove abandoned wiring to source of supply.
h. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
i. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
j. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
k. Existing electronic safety system components are indicated on demolition plans. Verify exact location and number of existing devices and components in field. Only partial existing systems shown. Locations of items shown on Drawings as existing are partially based on Record and other Drawings which may contain errors. Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish intent of Contract Documents.
l. Remove abandoned wiring to leave site clean.
m. If existing electrical equipment contains PCBs (Polychlorinated Biphenyl), replace with new non-PCB equipment. Dispose of material containing PCBs as required by federal and local regulations.
n. Repair adjacent construction and finishes damaged during demolition work.
o. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

5. Existing Fire Alarm System: Maintain existing system in service during construction.
Disable system only to make switchovers and connections.
a. Notify Owner before partially or completely disabling system.
b. Notify local fire service.
c. Make notifications at least five working days in advance.
d. Make temporary connections to maintain service in areas adjacent to work area.

3.13 ACCEPTANCE

A. Confirm requirements in Section 01770, Contract Closeout Procedures. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:
1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
a. Cleaning
b. Operation and Maintenance Manuals
c. Training of Operating Personnel
d. Record Drawings
e. Warranty and Guaranty Certificates
f. Start-up/test Documents and Commissioning Reports

3.14 FIELD QUALITY CONTROL

A. Confirm requirements in Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and the following:

1. Tests:
   a. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Closeout Documents.
   b. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.15 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement in letter that electronic safety systems were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in operating and maintenance manuals.

END OF SECTION
SECTION 28 05 13
SECURITY SYSTEM CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. General: Furnish engineering, labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as required to make a complete working security system installation, as described in these specifications.

B. Section Includes:
   1. Wire and cable
   2. Compression Seal BNC Connectors

C. Related Sections:
   1. Consult other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
   2. Section 28 00 00 – Basic Security Requirements: includes general project requirements, submittal formats, installation, and warranty requirements.
   4. Section 26 05 33 – Raceways: includes pathway types in different areas of the project.

1.02 SUBMITTALS

A. Product Data: Submit product information, including:
   1. Cable Description and Use
   2. Jacket Rating
   3. Outside Diameter (of the overall wire or cable)
   4. Manufacturer and Part Number

PART 2 - PRODUCTS

2.01 WIRE AND CABLE

A. General
   1. Provide required wire and cable sized to allow for voltage drop on long runs and effectively shielded as required to allow the routing of 12 & 24V power and video signal cable in the same conduit without interference or signal noise.
2. Cable installed outdoors or in underground conduit must contain a PVC or Polyethylene jacket to prevent water intrusion and compliant with the TIA-455-82B water infiltration test.

3. Cables installed indoors to contain a plenum rated jacket (type CMP).

B. Manufacturers:
   1. West Penn
   2. Belden
   3. Or Equal

C. Access Control & Alarm Monitoring System
   1. Plenum Jacketed Cable
      a. #18/2 AWG unshielded: West Penn #25224B, door contact cable
      b. #18/4 AWG unshielded: West Penn #25244B, REX and alarm device cable
      c. #18/6 AWG shielded (overall): West Penn #253186B, card reader cable
      d. #16/2 AWG unshielded: West Penn #25225B, lock power cable
      e. #14/2 AWG unshielded: West Penn #25226B, lock power cable from local power booster to exit device
      f. #24/4 AWG shielded (overall): West Penn #D4854, RS-485 communications cable

D. Intrusion Detection System
   1. Plenum Jacketed Cable
      a. #22/2 AWG unshielded: West Penn #25221B, door contact cable
      b. #22/4 AWG unshielded: West Penn #25241B, keypad and alarm device cable
      c. #18/2 AWG unshielded: West Penn #25224B, control panel power cable

E. Video Surveillance System
   1. Cabling for IP cameras provided by Telecommunications contractor. Refer to Section 27 15 13 – Communications Horizontal Twisted Pair Cabling.

2.02 MISCELLANEOUS COMPONENTS

A. Cable Ties
   1. General
      a. Provide Velco-style cable ties on security cabling within telecommunications spaces and covered wireways.
      b. Dress and bind cabling with cable ties every 24” minimum.
      c. Width: 0.75 inches
      d. Color: Black

   2. Manufacturer:
a. Panduit #HLS-15-R-0 Black, 15 feet roll, cut to length
b. Or Equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. Label cables in accordance with Section 28 05 53 – Security System Labeling.

B. Horizontal Cable Installation and Routing
   1. Provide wire and cable with a continuous, splice-free sheath for the entire length of run between designated connections or terminations. Splices not permitted.
   2. Place cables within designated pathways, such as cable tray, basketway, cable hangers, etc. Do no fasten (such as with cable ties) or attach cables to other building infrastructure (such as ducts, pipes, conduits, etc), other systems (such as ceiling support wires, wall studs, etc), or to the outside of conduits, cable trays, or other non-approved pathway systems.
   3. Place and suspend cables and conductors during installation and termination in a manner to protect them from physical interference or damage. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation or termination at no additional cost.
   4. Route cables at 90-degree angles, allowing for bending radius, along corridors for ease of access.
   5. Do not exceed manufacturer's limits for pulling tension.
   6. Do not use cable-pulling compounds for indoor installations.
   7. Route cables under building infrastructure (such as ducts, pipes, conduits, etc) so the installation results in easy accessibility to the cables in the future. Do not route cables over building infrastructure.
   8. Dress and secure coaxial cables to preclude stress and/or deformation.
   9. Install shielded wiring or route in separate raceways as recommended by the manufacturer's current requirements.
   10. Place cables 6", minimum, away from power sources to reduce interference from EMI.
   11. Do not run signal wire and cable in parallel to power (120VAC).
   12. Make connections to screw-type barrier blocks with insulated crimp-type spade lugs. Size lugs properly to assure high electrical integrity, i.e., low resistance connections.
   13. Follow manufacturers recommended guidelines for installation.
   14. When exiting the primary pathway (such as basketway or cable tray) to the work area, exit via the top of the pathway. Secure the cables to the pathway using an approved cable tie.

C. Cable Routing and Dressing within Telecommunication Rooms
1. Place cables within the overhead cable support and, when routing vertically, fasten the cables onto wall-mounted vertical cable support every 24 inches on-center using cable ties.
2. Only use Velcro type cable ties within the IDF.
3. Neatly bundle (dress cable longitudinally) and support security cables within overhead cable runways.
4. Dress and bind cabling with cable ties every 12” minimum.
5. Provide 4 feet, minimum, sheathed cable slack – length not to exceed permanent link maximum length requirement. Place the slack within the screw cover gutter wireways.

### 3.02 CABLE SUPPORT

#### A. Horizontal Support

1. Concrete and Metal construction (Above Ceiling)
   a. Provide separate and dedicated cable support system for security cable runs. Anchor cable support system to structural ceiling. Support and tie cables at a maximum of 5-foot intervals.

2. Wood Construction (above ceiling and no ceiling)
   a. Support cable utilizing appropriately sized drive rings or "D" rings.
   b. Fasten rings to structural ceiling.
   c. Install drive rings at approximately 5 foot intervals.
   d. Route cable through drive rings and cable tie at 10 foot intervals, or every other drive.

#### B. Vertical Support

1. Riser Systems
   a. Route cable through conduit in vertical riser systems.
   b. Terminate conduit at each stacked closet in a lockable junction box. Refer to Section 28 00 00 – Basic Security Requirements for minimum sizing of junction boxes and equipment enclosures.
   c. Fastened entire cable group to the inside of junction box at every other floor or approximately every 24 feet.
   d. Fasten cable in Junction box utilizing cable ties equipped with eyelets designed to accept screws for fastening or approved equivalent method.

2. Vertical cable on floor space not in riser system
   a. Route cable from below suspended ceiling devices to above ceiling when possible.
      1) Provide conduit and firestoppping for cable routed in fire rated wall assemblies.
      2) Provide conduit for cable routed from below ceiling devices to above ceiling on concrete tilt up style walls.
   b. Cable routed vertically from devices with no suspended ceiling.
1) Provide conduit stub from device junction box to 14 feet above finished floor minimum.

END OF SECTION
SECTION 28 05 53
SECURITY SYSTEM LABELING

PART 1 - GENERAL

1.01 SUMMARY

A. General: Furnish engineering, labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as required to make a complete working security system installation, as described in these specifications.

B. Section Includes:

1. Labeling of wire, cable, security devices, enclosures, and raceways.

C. Related Sections:

1. Consult other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.

2. Section 28 00 00 – Basic Security Requirements: includes general project requirements, submittal formats, warranty, and installation requirements.

1.02 SUBMITTALS

A. Product Data: Submit the following:

1. Product information for components specified herein.

2. List of equipment (wire, cable, devices, enclosures, and raceways) and the corresponding text for the label.

PART 2 - PRODUCTS

2.01 NAMEPLATES

A. Engraved, plastic laminated nameplates, signs, and instruction plates. Engrave stock melamine plastic laminate 1/16 inch minimum thickness for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Use white letters for engraved nameplates and punch for mechanical fasteners.

2.02 LABELS

A. Wire and Cable Labels:

1. General
   a. Self-laminating adhesive laser labels.
   c. Cable size: 0.16 – 0.32” OD
   d. Color: white with black lettering
2. Manufacturer:
   a. Panduit #R100X125V1T, #R100X150V1T, and R100X225V1T wire marking labels
   b. Brady #WML–211-295 and #WML-311-292 wire marking labels
   c. Or Equal

B. Device Labels:
   1. Self-laminating, type on tape, adhesive labels. Use Helvetica 12 pt text

PART 3 - EXECUTION

3.01 INSTALLATION

A. General Requirements
   1. Label the security system components. The components include, but are not limited to, the following:
      a. Equipment Enclosures
      b. Conduits
      c. Security Devices
      d. Batteries
      e. Wires and Cables
      f. Equipment Racks
      g. Terminal Blocks
      h. Relays
      i. Patch panels, and the termination positions within the patch panels.
   2. Labels to coincide with device IDs used on the record drawings.
   3. Degrease and clean surfaces to receive nameplates and labels
   4. Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using machine screws.

B. Equipment Cabinets
   1. Label SEC enclosures associated with the security system with a nameplate.
   2. Mount label on exterior of door, centered horizontally, and positioned one-third of the door height vertically from the top.
   3. Example: Line 1: “SEC-01” (1/2 inch high letters)
      Line 2: “Security Equipment Cabinet” (1/4 inch high letters)

C. Conduits
   1. Write the destination for every conduit entering a junction box, SEC, and CEC enclosure, or wireway using a black permanent ink marker next to the conduit inside the box.
   2. Example: “To SEC-01”
D. Security Devices
1. Label devices associated with the security system with a permanent machine generated, laminated, label. Use 12 point Helvetica text with a clear background. Use white or black lettering depending upon the color of the device.
2. Label each device in a concealed location with the system point number and address.

E. Batteries
1. Label power supply batteries with the month and year they were installed.
2. Example: “April 2012”

F. Wire and Cable
1. Identify wire and cable clearly with permanent machine-generated labels wrapped about the full circumference within one (1) inch of each connection.
2. Indicate the cable ID designated on the associated field or shop drawings or run sheet, as applies.
3. Assign wire or cable designations consistently throughout a given system; i.e., each wire or cable to carry the same labeled designation over its entire run, regardless of intermediate terminations.
4. Provide labels where wire and cable first enter and exit from conduit, junction or distribution boxes; locate labels within six (6) inches of the point of exit.
5. Positional labels so they are clearly visible without the need to remove wire management or other obstructions.
6. Label cables at both ends of a run and within pull and junction boxes using machine generated wrap-around labels.

3.02 CABLE LABEL FORMAT

A. From Panel to Field Device
1. Line 1: Device Type and Device Number
2. Line 2: Panel ID – Port Number
3. Example: CR 001
   PANEL 2 – CR5
4. Standard Device Types
   a. CR = Card Reader
   b. K = Camera
   c. ET = Entry Telephone
   d. R = Relay Output
   e. A = Alarm Point
5. Standard Port #s
   a. CR = Reader
b. M = Monitored Input  
c. R = Relay Output

B. From Door Junction Box to Card Reader
1. Line 1: Device Type and Device Number
2. Line 2: Panel ID – Port Number
3. Example: CR 001  
   PANEL 4 – CR3

C. Miscellaneous Examples:
1. From Door Junction Box to Door Contact  
   a. CR001  
   b. DC  
2. From Door Junction Box to Rex Alarm  
   a. CR001  
   b. REX ALM
3. From Panel to Rex  
   a. CR001  
   b. REX PWR  
   c. 12 VDC
4. From Panel to Lock  
   a. CR001  
   b. LCK PWR  
   c. 24 VDC

D. Communications Cable
1. Line 1: Communication Type and Direction
2. Line 2: Panel ID
3. Example: RS-485 TO  
   PANEL 2
4. Typical Communication Types  
   a. RS-485  
   b. RS-232  
   c. RS-422

END OF SECTION
SECTION 28 08 00
SECURITY SYSTEM ACCEPTANCE TESTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. General: Furnish engineering, labor, materials, apparatus, tools, equipment, and transportation required to thoroughly test the completed security system installation as described in these specifications.

B. Base Bid Work

1. Full testing of a completed security system which includes:
   a. Develop, submit, and obtain Engineer’s approval of security system Pre-functional and Functional testing forms.
   b. Complete 100% Pre-functional test of the security system. Submit Pre-functional testing documentation reflecting that all security devices, cabling, locking hardware, power, interfaces to other systems, IT switches, computer/servers and other components required for a completely functional security system are provided per project documents.
   c. Complete 100% Functional test of the security system. Submit Functional testing documentation reflecting that all security equipment, components, interfaces, and programming are functioning correctly per project documents. Upon receiving approval of functional testing documentation, schedule final acceptance testing activities to be witnessed by Engineer and/or Owner.
   d. Demonstrate 100% security system functionality to the Engineer and/or Owner. Document testing activities and submit with final As-Built drawing.

C. Related Sections:

1. Section 28 00 00 – Basic Security Requirements
2. Section 28 05 13 – Security System Cabling
3. Section 28 05 53 – Security System Labeling
4. Section 28 08 00 – Security System Acceptance Testing
5. Section 28 13 00 – Access Control and Alarm Monitoring System
6. Section 28 16 00 – Intrusion Detection System
7. Section 28 23 00 – Video Surveillance System

1.02 SUMMARY OF SYSTEM COMMISSIONING ACTIVITIES

A. Overview
1. The purpose of system commissioning is to ensure the security system operates properly when it is needed most. Security systems are very complex from both an equipment and programming standpoint, and thorough testing is necessary to ensure correct operation.

2. Perform testing activities after-hours or on weekends when the system is “quiet” and the building is generally unoccupied. This will minimize the amount of irrelevant activity in the system activity reports that will be used as a record of the pre and final test results.

B. Pre-Functional Test

1. Perform a 100% pre-functional test of system aspects to verify correct operation prior to scheduling the final test. The pre-test will help to make the final test run smoothly when demonstrating the system’s operation to the Owner and Engineer.

2. Document the results of the pre-test using the approved test forms and submit a copy to the Engineer along with the system activity reports.

C. Functional Test

1. Perform a 100% functional test of system aspects to verify correct operation prior to scheduling the final test. The functional test will help to make the final test run smoothly when demonstrating the system’s operation to the Owner and Engineer.

2. Document the results of the pre-test using approved test forms and submit a copy to the Engineer along with the system activity reports prior to final acceptance test.

D. Final Acceptance Test

1. Perform a final test of the system in the presence of the Engineer and/or Owner to demonstrate correct operation of the security system.

1.03 SUBMITTALS

A. Operation and Maintenance Manuals: Submit the following for review and comment at the completion of the project:

1. Functional Design Manual: Includes a detailed explanation of the operation of the system.

2. Hardware Manual which includes:
   a. Pictorial parts list and part numbers
   b. Pictorial and schematic electrical drawings of wiring systems, including devices, control panels, instrumentation and annunciators
   c. Telephone numbers for the authorized parts and service distributors
   d. Include service bulletins

3. Software Manual which includes:
   a. Use of system and applications software
b. Initialization, start-up, and shut down procedures

c. Alarm Reports

4. Operator’s Manual which fully explains procedures and instructions for the operation of the system and includes:
   a. Computers and peripherals
   b. System start up and shut down procedures
   c. Use of system, command, and applications software
   d. Recovery and restart procedures
   e. Graphic alarm presentation
   f. Use of report generator and generation of reports
   g. Data entry operator commands
   h. Alarm messages and reprinting formats
   i. System access requirements

5. Maintenance Manual which includes:
   a. Instructions for routine maintenance listed for each component, and a multi-page summary of component’s routine maintenance requirements.
   b. Detailed instructions for repair of the security system.
   c. A summary of the software licenses, including license numbers, quantity of clients, summary of the software options provided and database capabilities.
   d. A summary of the TCP/IP address used and which system component they are associated with. Include the gateway address, subnet mask, DNS server, and host name information.

6. Test Results Manual, which includes the document results of tests, required under this Specification, organized by System, Floor, and Door.

7. Record Drawings Manual which includes 11”x17” prints of record drawings as described below.

B. Record Drawings: Submit the following for review and comment at the completion of the project:

1. Drawings to fully represent installed conditions including actual locations of devices, actual cable and terminal block numbering, and correct wire sizing as well as routing. Record changes in the work during the course of construction on blue or black line prints.

2. Include drawings submitted as part of the Shop Drawing package, plus additional information required to accurately document installed conditions.

3. Include the following additional information:
   a. Device addresses & IP address information.
   b. Settings for each camera (lens specs, mm setting, auto shutter setting, and other available camera settings, etc.)
4. Final acceptance will not be made until the Engineer approves the record drawings.

1.04 QUALITY ASSURANCE

A. Provide a project manager to coordinate the security system commissioning work with other trades.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 SCHEDULING

A. Coordinate security acceptance testing with the General Contractor, and provide specific information on pre-test and final-testing activities to be entered into the overall project construction schedule.

3.02 TESTING REQUIREMENTS

A. Site Tests

1. Perform a 100% pretest of the system prior to final testing by the Engineer. Provide the Engineer with a minimum of a 5 day notice prior to scheduling testing.

2. At the conclusion of the work on a floor, test the system on that floor to verify proper operation and reporting of devices.

3. Work with the door hardware supplier to resolve electric hardware failures and door alignment/closure problems.

4. At the completion of the work, test the entire system to verify proper operation. At a minimum, include these tests:
   a. Building Perimeter Test: Test doors, cameras, and devices related to securing the perimeter of the building.
   b. MDF/IDF Test: Test devices related to securing the MDF and IDF rooms. Inspect system panels, power supplies, and other related security equipment located in these areas.
   c. Access Control System Test: Test the software for correct programming and setup. Test control and alarm communication through both campus and District security workstations. Verify correct integration with the IDS and Video Surveillance Systems.
d. CCTV Recording System Test: Test the recording system for correct programming, alarm recording, and event retrieval. Verify correct integration with the ACAMS and IDS system for alarm call-up. Test and verify CCTV system viewable from workstations.

e. Intrusion Detection System Test: Test the alarm dialer and duress stations for correct programming and operation. Verify correct arming/disarming functions from each keypad and alarm partitioning. Verify integration with ACAMS and Video Surveillance Systems.

f. CCTV Camera Test: Review cameras for proper coverage, video quality, physical installation, etc.

g. Other Readers/Door Test: Test remaining card readers, scheduled unlock doors, and exit-only doors not included in the above tests.

h. Glass Break Test: Test the glass break detectors for correct operation.

i. Motion Detector Test: Test the motion detectors for correct operation and coverage.

j. Battery and UPS Load Test: Disconnect AC power to security system equipment to verify battery operation functions and system remains fully operational.

B. Test Preparation

1. Provide device identification numbers that differ from or were not included on the original contract drawing set.

2. Provide a complete systems point list.

3. Provide paper and toner for the printer so that an event log can be printed out and attached to the test reports as verification of test sequence and systems response.

4. During testing, provide a minimum of three technicians familiar with the installation to assist with the test. Stage the technicians as follows: one at the host, one at the device being tested, and one runner responsible to furnishing tools, step ladders, etc.

5. Provide radios for use by the Engineer and Owner during testing.

6. Provide pre-programmed access cards for use during testing. Provide one card for each access level.

3.03 TEST PROCEDURES

A. Refer to the test forms for testing procedures for each type of device/system.
3.04 DOCUMENTATION

A. Provide a full-sized blueline drawing containing a detailed wiring diagram (layout of equipment/elevation, complete parts list, and a complete wiring diagram for each ACU & I/O Board) for each SEC. Fold the diagram and place it inside a clear plastic pocket affixed to the inside door of the SEC.

B. Provide a service log on the inside door of each SEC. Include columns for the following information: date of service, description of work performed, service technician(s), service company in the service log. Place the service log inside a separate clear plastic pocket affixed to the inside door of the SEC.

3.05 DEMONSTRATION

A. On completion of the acceptance test, instruct the owner's representatives, at a time convenient to them, in the operation and testing of the system.

B. Utilize the database for the project during training to give the users a project specific example to learn from.

C. Provide a minimum of 12 hours of on-site training by a factory trained representatives. Maintain a sign in sheet with names and dates of persons trained and forwarded to owner upon completion of training.

D. Provide for two Owner’s representatives to attend factory certification training (off-site) for both the following systems:
   1. Access Control System
   2. Video Surveillance System

END OF SECTION
SECTION 28 13 00
ACCESS CONTROL & ALARM MONITORING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. General: Furnish engineering, labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as required to make a complete working Access Control & Alarm Monitoring system installation, as described in these specifications.

B. Section Includes:
   1. ACAMS control panels, input/output modules, and card readers
   2. ACAMS power supplies
   3. Alarm initiating devices, including: magnetic switch contacts, and request-to-exit sensors.
   4. Interface to electric door hardware and ADA door operators
   5. Interface to security subsystems to allow bi-directional communication with one another

C. Products Installed But Not Supplied Under This Section:
   1. Electric feed-through power transfer hinges
   2. Electrified locking hardware cable and termination to transfer hinge and security system

D. Products Furnished and Installed Under another Section:
   1. 120V power
   2. Conduit, junction boxes
   3. ADA door operators and push buttons
   4. Fire/life-safety system interface relays
   5. Electromagnetic door holders
   6. Network connectivity for ACAMS devices via Owner’s local/wide area network

E. Related Sections:
   1. Consult other Divisions, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
   2. Section 08 71 00 – Door Hardware: for wireless card reader with integrated locking hardware product requirements.
   3. Section 28 00 00 – Basic Security Requirements: for submittal formats, warranty, general product requirements, and installation requirements.
4. Section 28 05 13 – Security System Cabling: for cable requirements related to the ACAMS.
5. Section 28 05 53 – Security System Labeling: for device labeling requirements.
7. Section 28 16 00 – Intrusion Detection: for interface requirement to the ACAMS.
8. Section 28 23 00 – Video Surveillance System: for interface requirement with the ACAMS.

1.02 SYSTEM DESCRIPTION

A. Overview

1. The ACAMS is a distributed network of control panels connected to and programmed from an existing host server and client workstations, one located at the District Office and the others at each respective campus.
2. The ACAMS is utilized for electronically controlling access to students, delivery personnel, and staff entrances to the building(s).
3. The ACAMS consists of an existing Software House CCURE 9000 server located at the District Office in Martinez, existing client workstations, control panels, card readers, battery powered wireless card readers with integrated locking hardware, wireless interface modules and alarm initiating devices. The host server communicates with the field panels via the Owner’s local/wide area network.
4. Card reader doors must tie into the existing District-wide host server. Develop schedules to automate the opening and closing of the building(s), including unlocking doors, bypassing alarms, and enabling ADA actuation devices.
5. Card readers used in classrooms and/or additional locations as identified by the college must include emergency lockdown capability for shelter in place. The lockdown capability will:
   a. Disable the exterior reader and only allow excess via mechanical key only.
   b. Notify Police Services via the access control system and/or the intrusion detection system of emergency lockdown alarm event.
6. The ACAMS also provides secondary alarm monitoring and alarm partition control of the IDS control panels through software integration.

B. Access Control & Alarm Monitoring System

1. Provide ACAMS interface software license for IDS control panels and program to enable bidirectional alarm communication for alarm notification and partition arm/disarm control.
2. Provide ACAMS interface software to VSS network video recorders to enable alarm event recording and automatic call up of associated cameras upon alarm activation (forced door, door held open, etc).
3. Provide ACAMS control panels located in the telecommunication rooms as indicated on project drawings. Coordinate exact location of control panels with local IT department. Panels support up to 16 card readers with locking control outputs and multiple general-purpose input/output modules for automation.

4. Provide proximity wireless card readers with integrated locking hardware. Wireless readers are battery powered.

5. Provide wireless interface modules. Field determine the quantity and exact locations of the wireless interface modules for full coverage of wireless card readers.

6. Provide wireless survey kit to verify wireless interface module placement.

7. Provide input and output modules in a lockable enclosure to support the project specific security system requirements.

8. Provide multi-technology card readers with optical tampers on doors deemed critical to the security of assets subject to a high possibility of theft, sensitive information, or other areas of critical nature and doors with operational requirements such as building entrances, as noted on the project drawings.

9. Provide alarm contacts and request-to-exit motion detectors for card reader controlled doors. Include output from ACAMS to indicate alarm contact status to IDS.

10. Provide alarm contacts for non-card reader controller perimeter doors as indicated on project drawings.

11. Provide local audible alarms at monitored emergency exit-only doors and special card reader doors as indicated on project drawings. Local audible alarms to sound upon alarm activation (forced door, door held open, etc). Provide monitoring of the keyswitch and remote reset through the ACAMS.

12. Utilize IDS integration to monitor motion detector and duress alarms through the ACAMS workstation.

13. Provide interface to ADA automatic/power assist door operator and corresponding actuator push plates or optical motion detection actuators.
   a. When door locked, exterior push plate/optical sensor is disabled
   b. When door unlocked, even momentarily, push plate/optical sensor is enable.
   c. Interior push plate/optical sensor unlocks door and triggers automatic door operator at all times.

14. Provide 12/24VDC ACAMS device and lock power supplies as indicated on project drawings with enclosure tamper switches.

15. Provide battery backup of system components and power supplies.

C. Tamper Monitoring

1. Provide additional monitor input points for monitoring the following:
   a. Tamper switches located within each security equipment enclosure and wireway (use unsupervised inputs for this purpose).
b. Supervision of power supplies and batteries (use unsupervised inputs for this purpose).
c. Tamper switches located within each door junction box.

### 1.03 SUBMITTALS

**A. Contractor Qualifications:** Submit certification letters for the manufacturer of the ACAMS.

**B. Product Data:** Submit product information for components specified herein.

**C. Shop Drawings:**

1. Device placement on floor plans
2. Point-to-Point Diagrams: Include wiring, points of connection and interconnecting devices between the following:
   a. ACAMS control panel
   b. ACAMS card reader and input/output modules
   c. ACAMS power supplies
   d. Card Readers
   e. Wireless Card Reader interface modules
   f. Alarm contacts and request-to-exit sensors
   g. Local audible alarms
   h. Interface to electrified door hardware
   i. Interface to ADA auto operators and actuators
   j. Hardwired interfaces to IDS
   k. Cable conductors (identify conductors on the point-to-point diagrams with the same tag as the installed conductor)

3. Schedules: Provide schedules for ACAMS control panels that show each point ID with a description of the connected devices.

4. Block Diagram/Riser Diagram: Show the ACAMS components, conduit, wire types, and sizes between them, including cabling interties between termination hardware.

5. Custom mounting details

### 1.04 EXTRA MATERIALS

**A. Provide 10% spare parts of total installed the following:** (Round up to the next complete device)

1. Card Readers
2. Fuses (Place five (5) of each type of fuse inside each SEC and power supply housing).
3. Relays

### PART 2 - PRODUCTS
2.01 MANUFACTURERS
A. Access Control & Alarm Monitoring System
   1. Software House CCURE 9000 to match campus standards

2.02 ACAMS CONTROLLERS
A. General
   1. An intelligent controller with integrated battery backup, database, and communication ports that supports 16 card readers.
   2. Supports multiple communication channels to which a variety of devices can connect.
   3. Supports hardware modules used for additional memory and/or for future feature enhancements.
   4. Functions provided include:
      a. Central control for attached devices and addressable modules
      b. Makes decisions for access
      c. Responds to monitor activity
      d. Receives input to control its decision making
      e. Reports activity to other devices

B. Features
   1. Supports HID proximity, MIFARE, and DESFire card reader formats
   2. Supports flash upgrades for firmware updates
   3. Utilizes an onboard Ethernet NIC for TCP/IP communication, supporting IPv4 and IPv6
   4. Global input/output and anti-passback functionality
   5. Capable of utilizing keypad commands to activate/deactivate events

C. Supports RS-485 or RS-422 connectivity to addressable modules:
   1. Input Module: Supports 8 Class A supervised input points
   2. Output Module: Supports 8 Form C dry contact relays
   3. Reader Interface Module: Supports 2 or 4 card readers with associated alarm contacts, request-to-exit devices, and lock outputs

D. Manufacturer
   1. Software House # iSTAR ULTRA 64MB control panel
      a. Accessories
         1) Software House # I8 input module
         2) Software House # R8 output module
         3) Software House # RM-4E reader interface module
         4) Allegion PIM400-485; Panel Interface Module
2.03 EQUIPMENT ENCLOSURES

A. General
1. Provide enclosures with butt hinged and lockable door containing a lock kit (keyed alike with other security enclosures on the project).
2. Provide perforated back panel for mounting control boards, relays, and terminal strips with enclosure.
3. Provide slotted wiring duct for routing security cabling within enclosure.
4. One tamper switch for each enclosure

B. Security Equipment Cabinets
1. Type: NEMA type 1 enclosure
2. Size: 36” x 24” x 6” minimum
3. Finish: ANSI 61 gray polyester powder paint finish inside and out
4. Manufacturer:
   a. Cooper B-Line # 36246-1PP with back panel and lock kit
   b. Hoffman #A36N24M with #A36N24MPP back panel and #A612AR lock kit
   c. Or Equal

C. Security Junction Boxes
1. Type: NEMA type 1 enclosure
2. Size: 12” x 12” x 6” minimum
3. Finish: ANSI 61 gray polyester powder paint finish inside and out
4. Manufacturer:
   a. Cooper B-Line # 12126-1PP with back panel and lock kit
   b. Hoffman # A12N126 with #A12N12PP back panel and # A612AR lock kit
   c. Or Equal

D. Slotted Wiring Duct
1. Type: Lead-free PVC with narrow finger design
2. Size: 1” x 1” minimum
3. Color: Light gray
4. Manufacturer:
   a. Panduit # Type-F narrow slot wiring duct
   b. Iboco # T1-1010 wiring duct
   c. Or Equal

2.04 WIREWAYS
A. General:
1. Provide screw cover wireway sections with open top assembly as shown on Security drawings.
2. Provide closure plates to secure end of wireway sections.

B. Screw Cover Gutter Wireways
1. Type: NEMA type 1 enclosure
2. Size: 4” x 4” x 48” minimum
3. Finish: ANSI 61 gray polyester powder paint finish inside and out
4. Manufacturer:
   a. Copper B-Line # 4448-G-NK lay-in painted wireway without knockouts
   b. Hoffman # F44T148GVP lay-in painted wireway without knockouts
   c. Or Equal
5. Accessories:
   a. Cooper B-Line # 44-E-NK closure plate without knockouts
   b. Hoffman # A44GCPNK closure plate without knockouts
   c. Or Equal

2.05 TERMINAL BLOCKS
A. General
1. Provide terminal blocks inside SEC for demarcation of elevator traveler and security cabling.
2. Provide DIN rails and other mounting accessories for a complete installation.

B. Modular Terminal Strips
1. Push-in style bridging system that utilizes the IDC termination method
2. Feed through style, single level
3. Modular design
4. Capable of mounting on standard 35mm DIN rails
5. Manufacturer:
   a. Phoenix Contact # QTC-1,5 terminal block
   b. Weidmuller
   c. Or Equal
6. Accessories:
   a. Phoenix Contact # NS-35/7,5 DIN rail
   b. Weidmuller
   c. Or Equal

2.06 CARD READERS
A. General
1. Presenting an access card to the reader initiates a single transmission to the ACAMS controller.
2. Rugged, weatherized polycarbonate enclosure, designed to withstand an operating temperatures of -22 to 120 degrees Fahrenheit (-30 to 65 degrees Celsius) and operating humidity of 5-95% non-condensing.
3. Utilizes a Wiegand protocol for communication for compatibility with standard access control systems.
4. Utilizes a multi-color LED and an audible sounder to indicate the status of the door.
5. Utilizes an internal tamper switch that will indicate an alarm condition if an unauthorized attempt is made to disassemble the unit.
6. FCC and CE certified, and conform to the following ISO standards:
   a. 15693 (CSN read-only)
   b. 14443A (CSN read-only)
   c. 14443B (CSN read-only)
7. Capable of reading the following frequencies and card formats:
   a. 125kHz – HID, Indala, or AWID proximity
   b. 13.56MHz – MyD, ISO 15693 CSN (MyD,ICODE, Tag-it), ISO 14443A CSN (MIFARE, DESFire), ISO 14443B CSN, and US Government PIV

B. Manufacturer
1. HID # multiCLASS series
   a. Wall mount: HID # RP40 multi-technology card reader
   b. Wall mount with keypad: HID # RPK40 multi-technology card reader with integrated keypad
   c. Mullion style: HID # RP15 multi-technology card reader

2.07 ACCESS CARDS
A. General
1. Utilizes a graphics quality surface that supports direct-to-card printing.
2. Capable of being produced with holograms, ultra-violet fluorescent inks, or other anti-counterfeiting features.

B. Manufacturer
1. HID ISOProx II proximity card, Corporate 1000 Program; verify card format with College in writing prior to ordering.

2.08 SECURITY SYSTEM PRINTERS
A. Badging System Printer
1. **Features**
   a. Print Method: Dye-sublimation, resin thermal transfer
   b. Resolution: Up to 300 dpi
   c. Colors: Up to 16.7 million, 256 shades per pixel
   d. Accept card thickness from 0.020 inches to 0.060 inches
   e. Capable of utilizing custom watermarks for additional security
   f. Includes Ethernet NIC option

2. **Manufacturer**
   a. HID # DTC550 card printer
   b. Zebra # P430i card printer
   c. Magicard # Tango 2e card printer
   d. Or Equal

### 2.09 ACAMS SECURITY WORKSTATION & COMPONENTS

**A. ACAMS Security Workstation**

1. Document the cost of this hardware at time of bid due to price reductions and advancements in technology. Prior to placement of order, provide upgrades to the most current model as requested by the Owner up to the cost of the specified product.

2. Provide complete prepackaged unit containing:
   a. Processor: Intel Core i7 Quad Core 870 2.93GHz, 8M L3Cache
   b. Memory: 4GB, 1333MHz FSB, DDR3 SDRAM, Non-ECC (2 DIMMS)
   c. Video Card: Dual 512MB, dual monitor compatible for support for up to 4 monitors
   d. Monitors: Two 22” widescreen monitors, 1920x1080 resolution, with digital video inputs
   e. Hard Drive: 250GB SATA, 7200 RPM and 8MB DataBurst Cache
   f. OS: Microsoft Windows 7 Professional, or latest OS supported by manufacturer
   g. Optical Drive: 16xDVD-RW
   h. Network Adapter: Gigabit Ethernet NIC

3. **Manufacturer**
   a. Dell # OptiPlex 980 series workstation
      1) Dell # USB Multimedia Pro keyboard
      2) Dell # USB optical mouse
   b. Or Approved Equal

**B. ACAMS Software**

1. Include software licenses: Badging software license
2. Manufacturer
a. Software House # C-Cure 9000 client software

C. UPS:
   1. Provide one UPS for each workstation furnished.
   2. APC or equal by BEST for backup of one CPU and two monitors. Connect UPS alarm condition output relay to security system. Provide smart software interface with UPS and operating system to facilitate automatic shut-down. Provide a separate UPS for each required workstation.

2.10 MAGNETIC CONTACT SWITCHES
   A. Wood, Steel, and Hollow Metal Doors
      1. General
         a. Mounting: Recessed
         b. Contacts: Single Pole, Single Throw
         c. Gap Distance: 0.5” maximum
      2. Manufacturer
         a. GE Security # 1078C 3/4” alarm contact switch
         b. GRI
         c. Or Equal
   B. Local Audible Alarmed Doors
      1. General
         a. Mounting: Recessed
         b. Contacts: Single Pole, Double Throw
         c. Gap Distance: 0.5” maximum
      2. Manufacturer
         a. GE Security # 1076C 3/4” alarm contact switch
         b. GRI
         c. Or Equal

2.11 REQUEST-TO-EXIT MOTION SENSORS
   A. General
      1. Power: 12 or 24VDC, 35mA
      2. Relay Output: 2 form “C” contacts
      3. Adjustable relay latch time
      4. Programmable retrigger or non-retrigger mode
      5. Programmable Fail Safe or Fail Secure Modes
      6. Radio Frequency Interference (RFI) Immunity range from 26 to 1,000 MHz at 50 v/m
B. Manufacturer
1. Bosch #DS160 with TP160 trim plate
2. Honeywell #IS320WH with IS310WHTP trim plate
3. Or Equal

2.12 LOCAL AUDIBLE ALARMS

A. General
1. Panel operating voltage selectable 12 or 24VDC at 150mA.
2. Keyswitch operation using rim cylinder provided by Owner to match existing standard.
3. Utilizes 80 Db horn.
4. Input points for door switch, alarm shunt, door status, tamper switch, and key switch override.
5. Output points for door propped alarm, intrusion alarm, door status, tamper switch, and key switch override.
6. Timers for access period, warning period, and auto reset.
7. Tamper switch to detect the removal of the unit from the electrical back box.

B. Manufacturer
1. Designed Security # 4200 local alarm sounder
2. Or Equal

2.13 ACAMS POWER SUPPLIES

A. General
1. Provides a 120VAC to 12 and 24VDC output, fully supervised power supply to power ACAMS field devices.
2. Utilizes 16 fused Class 2 rated power limited outputs.
3. Short circuit and thermal overload protection.
4. Integrated charger for sealed lead acid or gel type batteries.
5. Capable of providing a 10 amp supply current.
6. Supports a fire alarm disconnect to relay that individually selects any or all of the 16 outputs.
7. Enclosure with integrated tamper switch

B. Manufacturer
1. Altronix # MAXIM75 power supply
2. Or Equal

2.14 BATTERIES
A. General:
1. Voltage: 12.00
2. Amps: 12.00
3. Chemistry: SLA or VRLA valve regulated
4. Termination: Spade protected terminals

B. Manufacturer:
1. Yuasa #RE12-12 sealed lead acid 12V 12Ah battery
2. Interstate Batteries #SLA1105 sealed lead acid 12V 12Ah battery
3. Or Equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. ACAMS Control Panels
1. Place power supply and associated hardware in same location.
2. Install supervisory and end-of-line (EOL) resistors as required. Refer to Section 28 00 00 – Basic Security Requirements for EOL supervision requirements.
3. Connect power supply tamper switches to ACAMS for SEC hub monitoring.

B. Wireless Interface Module
1. Field determine best location for wireless card reader interface module. Locate module above accessible ceiling, whenever possible to avoid damage to units.
2. Connect wireless interface module to ACAMS panel using the RS-485 data bus.

C. Remote Reader Modules
1. Locate remote reader module in accessible ceiling space unless otherwise noted on the project drawings.
2. Power remove reader modules from power supply located at centralized security hub.

D. Four-State End-of-Line (EOL) Supervision
1. Provide designated resistors at device end of line per manufacturer’s EOL recommendation to provide four-state supervision of security device and cabling.
2. Provide EOL supervision for alarm contacts, local alarm sounders, motion detectors, help/desress buttons, and other designated security devices connected to the ACAMS and IDS.
3. Provide the following states of supervision:
   a. Contact closed = Secure
   b. Contact open = Alarm
   c. Short circuit = Line fault
d. Open circuit = Line fault

E. Card Readers
1. Wire the card reader’s multi-color LED to indicate the following status of the door.
   a. Red status indicates the door is secure (locked).
   b. Green status indicates the door is unsecured (unlocked).
   c. Yellow status indicates the card reader is not functioning (off-line/trouble), is processing a read request, or has denied access.
2. Utilize configuration card to enable optical tamper.
3. Wire the card reader’s optical tamper to spare input on the ACAMS reader module and jumper ground wire from door contact to provide a Normally Closed circuit.
4. The card reader to produce an audible beep tone to indicate to the user:
   a. The card was read and/or access was denied.
   b. Door is being held open and needs to be closed.

F. Door Hardware
1. Route power to electrically controlled locks on life-safety doors through fire alarm output to automatically unlock the door upon activation of Fire/Life-Safety system. Connect fire alarm output to the disconnect relay on the associated 24VDC lock power supply.
2. Setup and conduct a door hardware coordination meeting.
3. Coordinate the installation and termination of the security cable with the installation of the electric door hardware and transfer hinge.
4. Provide cable and terminate wires to delayed egress devices for monitoring activation of delayed egress by the ACAMS system.

G. Door Contacts
1. Install on protected (secured) side of door.
2. Install 6” from leading edge at top of door.

H. Request-To Exit Motion Detectors
1. Mount motion detector on the secured (protected) side of door.
2. Install motion detector so that detection pattern is not obstructed by Exit Signs, light fixtures and other objects that would interfere with proper operation.
3. Adjust relay hold time and pattern to properly detect valid exit and allow shunting of door contact.
4. Adjust detection sensitivity to pulse.
5. Mask detector lens to provide a confined detection area limited to the door handle or pushbar.
6. Run wire inside structural tube steel frame into back of condulet for cage locations.

I. Local Alarm Sounders
   1. Mount local alarm sounder as indicated on project drawings.
   2. Install local, square, and plumb. Set flush-mounted units so that the face of the cover, bezel, or escutcheon matches the surrounding finished surface.
   3. Mount so that there are no gaps, cracks, or obvious lines between the trim and the adjacent finished surface.

3.02 PROGRAMMING

A. Prior to the completion of construction, schedule and hold a meeting with the Owner to determine the programming criteria. Discuss the following:
   1. Door and device names
   2. Access card levels and door groupings
   3. Alarm priority levels
   4. Alarm integration with IDS including arming and disarming protocol through the ACAMS card readers (for example valid card disarms alarm partition while presenting card two times arms alarm partition)
   5. Schedules and time codes
   6. Holidays and holiday types (priorities)
   7. Action/responses from individual input points
   8. Standard and custom (expanded) reports
   9. Defining alarm messages and standard response messages applicable to site
   10. Routing of alarm points to selected pagers
   11. Routing of alarm points to operator’s workstations, printers, and history files
   12. Coordinate implementation of graphics with Owner. Develop sample graphic complete with icons and text. Alarms to appear on building floor plans depicting the nature and location of alarms. Review and revise graphic layout as required by Owner.
   13. System data base backup to external hard-drives

B. Document the results of the meeting and perform necessary programming to achieve the Owner’s requests.

C. System Operation, Alarm and Reporting Function: Program door control panel tamper switches to immediately reported as a separate “tamper” point to the system resulting in an alarm condition displayed in both text and graphic form on the applicable workstation(s) and an alarm message transmitted to the appropriate pager(s).

D. Receive CAD drawing files of floor plans and perform the following relative to system graphics:
1. Delete non-applicable drawing layers and details to arrive at simple floor plans of the building as built.
2. Convert drawings to a graphic file format compatible with the Owner’s access control and alarm monitoring system.
3. Load drawing files into the system.
4. Apply new and predefined icons and other points on each graphic to indicate point and control status.
5. Link graphic images to reader, monitor and control points.

E. Program routing of monitor and control points. Route activations and restore messages to one or more of the following locations as directed by the Owner’s Representative:
   1. One or more system workstations;
   2. One or more system printers;
   3. One or more alphanumeric pagers;
   4. History files in addition to the above;
   5. History files only.

F. Program the system such that reliance on a remote host for routine building operations, such as scheduled door commands and conditional events, are minimized to the greatest extent possible and decisions are made at the local building controller.

G. Program the system in a manner that minimizes the amount of time required for the users to make updates and maintain the system on a daily basis especially updates that impact card holder record updates. Nested programs, such as reader groupings used in access codes shall be used to the greatest extent possible such that single actions are required to update an entire card data population. If there is a question regarding the appropriate approach to programming, given the flexibility of most systems, contact the Engineer prior to any initial programming.

H. Complete other programming as required for system operation.

I. Program and setup the system such that no additional programming other than entering new access cards is required. Include setup of available features of the software.

J. Use the point names provided on the system point schedule.

K. Perform 2 full system back-ups at completion of initial programming and deliver one copy to owner with letter of Transmittal explaining information included in back-up and brief description of recovery procedures. Label the second CD-ROM and store onsite. Perform back-ups on a regular basis through the remainder of the project.

L. Customize menus with the assistance of the factory to “gray-out” features not used on project (such as elevator control).

M. Perform field software changes after the initial programming session to "fine tune" operating parameters and sequence of operations based on revised operating requirements.
3.03 TESTING

A. Commission ACAMS in accordance with Section 28 08 00.

END OF SECTION
SECTION 28 16 00
INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. General: Furnish engineering, labor, materials, apparatus, tools, equipment, transportation, temporary construction, and special or occasional services required to make a complete working intrusion detection system installation as described in these specifications.

B. Section includes:
   1. Intrusion Detection System, including digital communicator, keypad, and alarm devices.
   2. Door contacts, glass break detectors, motion sensors
   3. Duress alarm stations
   4. Interfaces and connections between intrusion detection subsystems to allow communication with one another

C. Products furnished and installed under another section:
   1. 120V power
   2. Network connectivity for IDS Panel via Owner’s local/wide area network
   3. Phone line

D. Related sections:
   1. Section 28 00 00 – Basic Security Requirements: for submittal format, warranty, general product requirements, and installation requirements
   2. Section 28 13 00 – ACAMS: for interface requirement to the intrusion detection system
   3. Section 28 05 13 – Security System Cabling: for cable requirements related to the IDS
   4. Section 28 05 53 – Security System Labeling: for device labeling requirements
   5. Section 28 08 00 – Security System Acceptance Testing: for testing requirements

1.02 SYSTEM DESCRIPTION

A. Overview
   1. The IDS is comprised of multiple areas that can be armed and disarmed independently of each other
   2. The IDS is utilized for after hours monitoring of the building(s), interior partitions and alarm zones. The IDS will also be utilized for 24-hour monitoring
of specific areas which include but are not limited to duress buttons, glass breaks, etc.

3. Activation of the IDS dials a remote, third party central station to first contact Police Services on campus during campus hours or dispatch the local Police Department after hours.

4. The IDS integrate with the ACAMS through software to send alarm information for secondary monitoring with the ACAMS and hardwired input points for remote monitoring of ACAMS door alarm contact status.

B. Intrusion Detection System

1. Provide an IDS control panel with integrated UL listed digital communicator shown on the project drawings. Panels support up to 8 areas and 64 zones by use of addressable input/output point modules.

2. Provide LCD command keypads as indicated on project drawings. Keypads allow for system arming and disarming by authorized users.

3. Provide wireless back up alarm communicator.

4. Provide under counter duress buttons as indicated on project drawings. Program duress alarm inputs as 24 hours zones.

5. Provide alarm contacts on perimeter doors and operable windows as indicated on project drawings.

6. Provide local audible alarms on doors indicated on project drawings.

7. Provide double pole, double throw alarm contacts on doors with local alarm sounders. Wire one contact to alarm sounder and wire the other contact to the IDS.

8. Provide 12VDC auxiliary power supply to support the field devices indicated on project drawings.

9. Provide battery backup of IDS components and power supplies for a minimum of 24 hours in the event of a power failure or emergency.

C. Interface with ACAMS

1. Connect ACAMS alarm outputs to the IDS control panel. Provide expansion modules as necessary to support the security devices shown on the project drawings.

2. Integrate IDS with ACAMS for alarm monitoring and alarm partition arming/disarming through ACAMS workstation(s).

D. Tamper Monitoring

1. Provide additional monitor input points for monitoring the following:
   a. Tamper switches located within each security equipment enclosure and wireway (use unsupervised inputs for this purpose).
   b. Supervision of power supplies and batteries (use unsupervised inputs for this purpose).
1.03 SUBMITTALS

A. Product Data: Submit product information for the intrusion detection systems, including:
   1. IDS control panel
   2. Keypads
   3. Cellular backup communicator
   4. Duress buttons
   5. Alarm contacts
   6. Local audible alarms
   7. Power supplies
   8. Calculations for backup batteries

B. Shop Drawings: Submit shop drawings containing the following:
   1. Device placement on floor plans
   2. Point-to-Point Wiring Diagrams: Include wiring, points of connect, and interconnecting devices between the following:
      a. IDS control panel
      b. IDS expansion modules and relays
      c. Keypads
      d. Alarm contacts
      e. Local audible alarms
      f. Power supplies
      g. Cable conductors (identify conductors on the point-to-point diagrams with the same tag as the installed conductor)
   3. Schedules: Provide schedules for the IDS control panel that show each alarm zone, applicable area or partition, and a description of the connected device.
   4. Custom mounting details

1.04 EXTRA MATERIALS

A. Provide 10% of the total installed, spare parts for the following: (Round up to the next complete device)
   1. Duress buttons
   2. Alarm contacts

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Intrusion Detection System
   1. DSC to match campus standard
2.02 IDS CONTROL PANELS

A. General
1. Integrated UL listed digital communicator with phone line monitor (loop or ground start).
2. Supports up to 64 alarm zones and 8 programmable areas or partitions.
3. Capable of utilizing multiple telephone numbers, primary and duplicate paths with main and alternate destinations.
4. Capable of utilizing a dual phone line switcher to monitor 2 phone lines.
5. Capable of sending daily automatic test and status reports.
7. Supports RS-232 connectivity to third party devices for automation.

B. Manufacturer
1. DSC PowerSeries #PC1864 8-64 zone control panel
   a. Accessories
      1) DSC #PC5200 Power Supply Module
      2) DSC #PC5204 Power Supply Module
   b. Expansion modules
      1) DSC # PC5100 Addressable Xone Expander
      2) DSC # PC5108 8-Hardwire Xone Expander
      3) DSC # PC 5208 Programmable Output Module
      4) DSC # IT-100 Integration Module
      5) Lantronix # UDS1100 w/ #500-163-R cable adapter
      6) DSC #TL250GS Internet Alarm Communicator
   c. Wireless back-up communication device
      1) DSC #GS3060; Universal Wireless Alarm Communicator

2.03 IDS KEYPADS

A. General
1. 32-character display
2. Keys light on entry or key press
3. Back lighted multi-key touch pad
4. User controlled brightness and loudness

B. Provide the ability to display for each detection point:
1. Alarm
2. Trouble
3. Supervisory
4. Faulted
5. Custom text

C. System wide displays include:
1. Local system test
2. Sensor reset
3. Event log

D. Manufacturer
1. DSC #PK5500 64-Zone LCD Full-Message Keypad

2.04 DURESS BUTTONS

A. General
1. Actuating lever, housing, and cover plate made of ABS fire-retardant plastic
2. Latching circuit with integrated LED
3. Contact: Normally Open or Normally Closed electrical loop, SPDT
4. Operating Voltage: 12VDC

B. Manufacturer:
1. GE Security # 3040 panic switch
2. Or Equal

2.05 MOTION SENSORS

A. General
1. Type: Passive infrared (PIR) detector with Fresnel type lens
2. Operating Voltage: 10-14VDC
3. Range: 35’ x 35’ minimum
4. Integrated tamper switch

B. Manufacturer
1. Wall mount
   a. Bosch # ISM-BLP1 blue line PIR detector
   b. Or Equal
2. Ceiling Mount
   a. Bosch # DS938Z panoramic PIR detector
   b. Or Equal
2.06 MAGNETIC CONTACT SWITCHES

A. Wood, Steel, and Hallow Metal Doors
   1. Mounting: Recessed
   2. Contacts: Single Pole, Single Throw
   3. Gap Distance: 1.0” maximum
   4. Manufacturer:
      a. GE Security # 1078 1” alarm contact switch
      b. Or Equal

B. Local Audible Alarmed Doors
   1. Mounting: Recessed
   2. Contacts: Double Pole, Double Throw
   3. Gap Distance: 0.5” maximum
   4. Manufacturer:
      a. GE Security # 1076D alarm contact switch
      b. Or Equal

C. Overhead Roll-Up Doors
   1. Mounting: Surface
   2. Contacts: Single Pole, Single Throw
   3. Gap Distance: 3.0” maximum
   4. Wiring: Armor Cable, 12” minimum
   5. Manufacturer:
      a. GE Security # 2205 floor mounted contact switch with 3’ armored cable lead
      b. Or Equal

2.07 LOCAL AUDIBLE ALARMS

A. General
   1. Panel operating voltage selectable 12 or 24VDC at 150mA.
   2. Keyswitch operation using rim cylinder provided by Owner to match existing standard.
   3. Utilizes 80 Db horn.
   4. Input points for door switch, alarm shunt, door status, tamper switch, and key switch override.
   5. Output points for door propped alarm, intrusion alarm, door status, tamper switch, and key switch override.
   6. Timers for access period, warning period, and auto reset.
7. Tamper switch to detect the removal of the unit from the electrical back box.

B. Manufacturer
1. Designed Security # 4200 local alarm sounder
2. Or Equal

2.08 IDS POWER SUPPLIES

A. General
1. Provides a 120VAC to 12/24VDC output, fully supervised power supply to power IDS field devices.
2. Utilizes 16 PTC Class 2 rated power limited outputs.
3. Short circuit and thermal overload protection.
4. Integrated charger for sealed lead acid or gel type batteries.
5. Capable of providing 6 amp supply current.

B. Manufacturer
1. Altronix # AL600ULXPD16CB multi-output power supply/charger
2. Or Equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. General
1. Follow manufacturers recommended guidelines for installation.

B. Components
1. IDS Control Panel
   a. Utilize dedicated power supplies to power control panel and associated expansion boards. Do not use plug-in transformers.
   b. Place power supply and associated hardware in same location.
   c. Install supervisory and end-of-line resistors on alarm initiating devices.
   d. Coordinate installation of phone jack and network connection in IDS control panel enclosure for communications to the contracted central station and integration with the ACAMS.

2. Keypads
   a. Mount keypads as indicated on project drawings.

3. Duress Buttons
   a. Mount duress buttons under work desks as indicated on the project drawings.
   b. Coordinate with architect and casework contractor to field determine exact placement prior to installation.
4. Motion Sensors
   a. Mount motion detectors as indicated on project drawings. Verify current location to maximize coverage prior to installation.
   b. Install motion detector so that detection pattern is not obstructed by exit signs, light fixtures, and other objects that would interfere with proper operation.

5. Door Position Contacts
   a. Program input on IDS control panel to receive alarm output from ACAMS indicating card reader door forced or door held-open alarm.
   b. Install on protected (secured) side of door.
   c. Install 6” from leading edge at top of door.

3.02 PROGRAMMING

   A. Prior to the completion of construction, schedule a meeting with the Owner to determine the following programming criteria:
      1. Zone or alarm point descriptions
      2. User authority levels to arm/disarm areas or alarm partitions
      3. Auto arm/disarm schedules
      4. Arm/disarm requirements through the ACAMS using specific credentials.
      5. Interface requirement with ACAMS
      6. Central station response from individual alarm points
      7. Central station password and call list information

   B. Document the results of the meeting and perform necessary programming to achieve the Owner’s requests. Program and setup the system such that no additional programming other than entering new access codes is required.

3.03 TESTING

   A. Commission the Intrusion Detection System in accordance with Section 28 08 00.

END OF SECTION
SECTION 28 23 00

VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. General: Provide engineering, labor, materials, apparatus, tools, equipment, transportation, temporary construction, and special or occasional services as required to make a complete working video surveillance system installation, as described in this specification.

B. Section Includes:
   1. VSS Monitoring and Recording System
   2. VSS Fixed, Multi-sensor, and PTZ IP cameras, lens, mounts, and housing
   3. VSS Power supplies
   4. Integration with ACAMS
   5. Interfaces and connections between VSS subsystems to allow communication with one another

C. Products Supplied But Not Installed Under This Section:
   1. None

D. Products Installed But Not Supplied Under This Section:
   1. None

E. Products Specified But Not Installed Under This Section:
   1. None

F. Products Furnished and Installed Under another Section:
   1. 120V power
   2. Ethernet cable back to telecommunication for IP cameras
   3. PoE switches in the telecommunications rooms for VSS connectivity via LAN/WAN

G. Related Sections:
   1. Consult other Divisions, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
   2. Section 280000 Basic Security System Requirements: includes general project requirements, submittal formats, installation, and warranty requirements.
3. Section 281300 Access Control & Alarm Monitoring System: includes product information for video integration with the ACAMS.

4. Section 280513 Security System Cabling: includes product information for wire and cable needed to support the video surveillance system.

5. Section 280553 Security System Labeling: includes label types and formats for security devices.

6. Section 280800 Security Acceptance Testing: includes the integrating testing/commissioning requirements for the video surveillance system.

1.02 DEFINITIONS

A. The Definitions of Division 1 apply to the 28 XX XX sections.

B. In addition to those Definitions of Division 1, the following list of terms as used in this specification defined as follows:

1. “IP”: Internet Protocol
2. “NVR”: Network Video Recorder
3. “VMS”: Video Management System
4. “PTZ”: Pan-Tilt-Zoom
5. “NAS”: Network Attached Storage
6. “PoE”: Power-over-Ethernet
7. “VSS”: Video Surveillance System

1.03 SYSTEM DESCRIPTION

A. Overview

1. The VSS is a network of IP cameras connected to and managed through a video management and recording server software and viewed on client workstations. The recording servers are managed and provided by District / Campus IT on centrally located servers.

2. The VSS consists of interior and exterior fixed and PTZ IP cameras, networked video recorders, management software, and dedicated client video monitoring workstations.

3. Cameras will integrate with the ACAMS through software and TCP/IP communication for alarm events which initiate video recording and tag video with specific alarms.

B. VSS Camera System - Base Bid

1. Provide VSS software and licenses capable of video motion detection and integration capabilities with the ACAMS software for alarm interface.

2. Provide the appropriate number of video licenses for IP cameras connected to the VSS video management system.
3. Coordinate installation of VSS camera licenses on centrally located network video server(s) hardware provided by the Owner. Provide District / Campus IT the bandwidth and storage requirements for cameras included under the project scope to ensure appropriate resources are available.

4. Provide NVR client workstation software for monitoring and viewing capabilities in the Police Services Office. Load client software on existing workstation located in the security office.

5. Coordinate network connection between IP cameras and existing security workstation at the Police Services Office with the District’s IT department prior to installation.

6. Coordinate one static IP network connection for each camera and/or IP video encoder.

7. Provide IP fixed VSS cameras as indicated on the floor plans.

8. Provide IP multi-sensor VSS cameras as indicated on the floor plans.

9. Provide IP PTZ VSS site camera as indicated on the floor plans.

10. Provide day/night cameras in outdoor locations with low light levels. Coordinate field of view with exterior light sources to prevent poor image quality.

11. Provide VSS camera power supplies (if needed) for PTZ and exterior camera enclosures.

12. Provide software interface to the ACAMS for alarm call up of cameras and PTZ specific presets on predefined alarm events.

C. Tamper Monitoring

1. Provide additional monitor input points for monitoring the following:
   a. Tamper switches located within each security equipment enclosure and wire way
   b. Supervision of power supplies and batteries

1.04 SUBMITTALS

A. Contractor Qualifications: Submit certifications for the manufacturers of the video surveillance equipment.

B. Product Data: Submit product information for components specified herein.

C. Shop Drawings:
   1. Device placement on floor plans.
   2. Point-to-Point Diagrams: Include wiring, points of connection and interconnecting devices between the following:
      a. Video surveillance system, monitors, and recording equipment
      b. Devices connected to the system
      c. Miscellaneous control relays
d. Conductors (identify conductors on the point-to-point diagrams with the same tag as the installed conductor)

3. Block Diagram/Riser Diagram: Show the video surveillance system components, conduit, wire types, and sizes between them, including cabling interties between termination hardware.

4. User interface graphics with icons and control buttons displayed.

5. Custom mounting details

1.05 EXTRA MATERIALS

A. Provide 10% spare parts of total installed the following: (Round up to the next complete device)

1. Fuses (Place five (5) of each type of fuse inside each power supply).

1.06 WARRANTY

A. Camera Systems

1. Provide a manufacturer’s warranty covering repair or replacement of defective parts for a period of one year from the date of shipment from the factory

2. Cameras and support devices
   a. Provide a manufacturer’s warranty covering repair or replacement of defective parts for a period of one year from the date of shipment from the factory.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Video Surveillance System

1. Network Video Recorder Software
   a. Salient Systems

2. IP Cameras
   a. Sony
   b. Axis Communications
   c. Samsung / Hanwha
   d. Or Approved Equal

3. Power Supplies
   a. Altronix
   b. Pelco
   c. Or Approved Equal
2.02 CAMERAS SYSTEMS

A. General

1. Type: Color, solid-state CCD with DSP technology, unless otherwise noted
2. Power: 24 VAC/VDC,
3. Imager: 1/3 inch format, unless otherwise noted
4. Lens Mount: Accept a "CS" mount auto or manual-iris lens
5. Synch: Adjustable line lock for synchronizing camera to power line. No auxiliary sync cable required.
6. Resolution: 640x480 minimum resolution (EIA RS-170), unless otherwise noted
7. Minimum Light Level: 0.1 fc imager illumination at full video, unless otherwise noted
8. Lens: Field determine, unless otherwise noted
9. Video transmission through IP or analog signals through IP encoder
10. All interior and exterior cameras which monitor door entryways and hallways shall be capable of facial recognition analytics and capture the required pixels per foot to distinguish subjects from a blacklist

B. Fixed IP Interior Dome Cameras

1. Complete prepackaged unit containing:
   a. Minimum 1280x720 megapixel resolution for fixed cameras, with progressive scan
   b. Resolution: 30 frames per second at all resolutions
   c. Video streaming: Simultaneous Motion JPEG and H.264
   d. Auto iris, varifocal lens of 2.5-6mm
   e. Security: IP address filtering and HTTPS encryption
   f. Power over Ethernet (IEEE 802.3af), Class 1
   g. Connectors:
      1) Ethernet 10/100 BaseT, RJ-45
      2) Terminal block for alarm inputs, output, and RS-485/422
      3) Power - Mini DC
   h. Dome housing

2. Manufacturer:
   a. Axis #P33 Series network dome megapixel camera
   b. Sony #SNCDH140 network dome megapixel camera
   c. Samsung / Hanwha
   d. Or Approved Equal

3. Accessories:
   a. Axis In-Ceiling Mount #5502-361 or Surface Mounting Plate #5502-401
b. Sony In-Ceiling Mount #YTICB45  
c. Samsung / Hanwha  
d. Or Approved Equal  

C. Exterior Fixed IP Mini-Dome Cameras  
1. Complete prepackaged unit containing:  
   a. Superior 1.3 megapixel image sensor quality with progressive scan  
   b. Resolution: 12 frames per second at 1280x1024 and 30 frames per second at 640x480  
   c. Video streaming: Simultaneous Motion JPEG and MPEG-4  
   d. Auto iris, varifocal lens of 2.8-10mm  
   e. Security: IP address filtering and HTTPS encryption  
   f. Power over Ethernet (IEEE 802.3af), Class 1  
   g. Connectors:  
      1) Ethernet 10/100 BaseT, RJ-45  
      2) Terminal block for alarm inputs, output, and RS-485/422  
      3) Analog video, BNC composite output  
      4) Audio line output, mini-jack  
   h. Vandal resistant dome housing  
   i. Manufacturer:  
      1) Axis #P33 Series megapixel network mini-dome camera  
      2) Or Approved Equal  
   j. Accessories (as required by application, refer to plans for information):  
      1) Axis #5502-321 Pendant kit  
      2) Axis #5017-611 Wall Bracket  
      3) Axis #5017-641 Corner Bracket  
      4) Axis #5017-671 Pole Bracket  

D. PTZ IP Dome Camera  
1. Provide IP PTZ camera with appropriate mount to flush mount into roof soffit  
2. Complete prepackaged unit containing:  
   a. 1/4” high-resolution color CCD camera & motorized zoom auto-iris lens  
   b. Resolution: Supports 1280x720 resolution at 30 frames per second  
   c. Resolution: 30 frames per second at all resolutions  
   d. High-speed pan and tilt that is stepper motor driven (belt-driven not acceptable).  
   e. Integral receiver/driver  
   f. Color  
   g. Integral 18X min optical zoom lens for exterior locations
h. Exterior cameras: wide dynamic range and auto day/night switching between color and B/W
i. Motion JPEG and H.264 video compression
j. Integrated heater and blower for exterior locations
k. Power over Ethernet plus (IEEE 802.3at) compatible
l. Electronic Image Stabilizer

3. Provide seismic support of unit attached directly to roof soffit structure.

4. Manufacturer:
   a. Sony #SNCRH164
   b. Axis #P5534 Series
   c. Or Approved Equal

5. Accessories:
   a. Sony #UNI#MB1 mounting bracket
   b. Axis #T91A Mounting Accessories
   c. Or Approved Equal

E. Multi-sensor camera

1. Complete prepackaged unit containing:
   a. Minimum resolution: (4) 1920 x1080
   b. Video Compression format: H.264
   c. Power over Ethernet (IEEE 802.3af, Class 2)
   d. Frame Rate: 12.5 fps at H.264
   e. Sensor: Four 1/2.8” progressive scan RGB CMOS sensors
   f. Vandal Resistant Dome

2. Manufacturer, Or Approved Equal:
   a. Axis P3707-PE
   b. Samsung / Hanwha

3. Accessories, Or Approved Equal:
   a. AXIS T91D61 Wall Mount including weather shield
   b. Samsung / Hanwha

2.03 VIDEO MANAGEMENT SOFTWARE

A. NVR Video Management Software

1. Video surveillance software must have software integration with ACAMS. Hard-wired input/output alarms is not acceptable.

2. Include software licenses:
   a. Camera licenses to support devices shown on project drawings
   b. Client workstation licenses to support a minimum of 5 concurrent users
   c. Internet Explorer client browser license
3. Manufacturer:
   a. Salient Systems Complete View Enterprise (to match existing standard)

2.04 POWER SUPPLIES/BATTERY CHARGERS

A. VSS System Power Supplies
1. 120 VAC input to 24 VAC output, continuous current, fully supervised power supplies for power to cameras.
2. Provide a separate fused connection to power supply per camera.
3. Exterior PTZ Camera
   a. Pelco #WCS 1-4 NEMA4X/IP66 rated for outdoor use
   b. AXIS #5000-001 24VAC Outdoor power supply
   c. Altronix
   d. Or Approved Equal

2.05 VSS LIGHTNING PROTECTORS

A. Power Line Protectors
1. Provide on power lines serving exterior cameras.
2. Manufacturer:
   a. PolyPhaser Corp #IS-SPTV
   b. DITEK
   c. Or Approved Equal

B. PTZ Data Line Protectors
1. Provide on data lines serving exterior IP cameras.
2. Manufacturer:
   a. PolyPhaser Corp #NX4-60-IG
   b. DITEK
   c. Or approved Equal

2.06 IP VIDEO ENCODER

A. General
1. Video Compression: Motion JPEG, MPEG-4 Part 2 (ISO/IEC 14496-3), Profiles: ASP and SP
2. Resolution: 4CIF, 2CIFExp, 2CIF, QCI
3. Frame Rate: Up to 30/25 per channel
4. Pan/Tilt /Zoom control
5. Alarm and event management
6. Channels: 4 minimum

B. Blade Video Server
   1. Hot-swappable
   2. Built-in, universal power supply
   3. Security: IP address filtering and HTTPS encryption
   4. Manufacturer:
      a. Axis #243Q blade video server
      b. Or approved equal

C. Video Server Rack Enclosure
   1. High density rack-mount solution
   2. Capable of storing a minimum of 3 interchangeable and hot-swappable blade video servers
   3. Manufacturer:
      a. Axis #291 1U video server rack
      b. Or approved equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. VSS Cameras
   1. Provide outdoor housing and mounts for exterior cameras.
   2. Field determine exact placement of cameras to ensure complete coverage.
   3. Coordinate location with obstructions such as columns or exceedingly high shelving units to avoid concealment opportunity.
   4. Field determine fixed camera lens size to ensure complete coverage.
   5. Route watertight flex from junction box to camera housing from below on exterior cameras.
   6. Provide 25 foot cable loop at PTZ location for relocating unit if required post installation
   7. Coordinate Network Data Drop with Telecom contractor for each IP Camera.
   8. Coordinate camera IP address with District IT staff.

B. VSS Power supplies
   1. Do not combine with Access Control & Alarm Monitoring System power supplies.

C. Network Video Recorder Storage
1. Coordinate installation of additional camera licenses and programming of cameras on owner provided network video server with District ITS

D. Surge Protection
   1. Provide surge protection for video, power, and control cable on exterior cameras.
   2. Provide protective device at the camera and encoder/encoder device.

3.02 PROGRAMMING

A. Coordinate a meeting with Owner’s IT representative to determine IP addresses and LAN/WAN utilization of IP cameras and NVRs.

B. Prior to the completion of construction schedule a meeting with the Owner and the Engineer to determine the programming criteria. Discuss the following:
   1. Camera naming
   2. PTZ Presets
   3. Schedules and recording parameters including quality and frame rate (including video motion detection)
   4. ACAMS alarm and event integration requirements for workstation pop-ups and recording.
   5. Video archiving schedule
   6. Live viewing requirements
   7. System data base backups

C. Document the results of the meeting and perform necessary programming to achieve the Owner’s requests.

D. Setup and program the system such that no additional programming required.

E. Use the camera naming convention agreed upon at in the programming meeting when programming point names into the system.

F. Perform a full system back-ups at completion of initial programming and deliver one copy to the Owner with a Letter of Transmittal explaining information included in back-up and brief description of recovery procedures.

G. Customize menus with the assistance of the factory to “gray-out” features not used on project (such as elevator control).

H. Perform field software changes after the initial programming session to "fine tune" operating parameters and sequence of operations based on revised operating requirements.

3.03 TESTING

A. Commission the video surveillance system in accordance with Section 280800.
END OF SECTION
SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Notification Appliance Circuit Panels
   3. Rate-of-Rise and Fixed Temperature Heat Detectors
   4. Photoelectric Type Detectors
   5. Duct-Mounted Smoke Detectors
   6. Relay Modules
   7. Control Modules
   8. Input Modules
   9. Fault Isolation Modules
   10. Combination Horn/Strobes
   11. Strobes
   12. Horns
   13. Miscellaneous Accessories

B. Scope: Provide modification and extension of the existing Siemens fire alarm system to accommodate remodel and addition.

C. In addition, provide design for the following as required in these Contract Documents: Fire Alarm System.

D. In addition, remove existing fire alarm system in remodel areas.

E. System Design:
   1. Design Criteria: Design systems utilizing equipment appliance and device layouts depicted in the contract documents.
   2. Design of Fire Alarm System:
      a. Provide design of the fire alarm system as required by code.
      b. Fire Alarm Sequence of Operation: Match Existing.
      c. Supervisory Sequence of Operation: Match Existing.
      d. Trouble Sequence of Operation: Match Existing.

1.2 RELATED SECTIONS

A. Contents of Division 28, Electronic Safety apply to this Section.

B. Division 26, Electrical requirements apply to this section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Division 28, Electronic Safety and Section 01410, Regulatory Requirements.
B. In addition, meet the following:

1.4 SUBMITTALS

A. Submittals as required by Division 28, Electronic Safety and Section 01330, Submittal Procedures.

B. In addition, provide:
   1. Shop drawings to include the following:
      a. Provide system designer NICET certification number or Engineer's signature and seal on shop drawings.
      b. Identification of system designer and evidence of qualification or certification of designer as required by AHJ.
      c. Floor plans indicating walls, doors, partitions, room descriptions, device/component locations.
      d. Ceiling height and ceiling construction details.
      e. A symbol legend with device catalog number, description, back box size and mounting requirements.
      f. Detailed riser diagram.
      g. Device address adjacent to each device symbol. Notification appliance circuit and number adjacent to each notification appliance symbol.
      h. Point to point wiring indicating the quantity and gauge of the conductors and size of conduit/raceway used.
      i. Wiring connection diagrams for control equipment, annunciators, power supplies, chargers, initiating devices, notification appliances, components being connected to the system and interfaces to associated equipment.
      j. Battery calculations for each battery backed fire alarm control unit.
      k. Voltage drop calculations for each notification appliance circuit, indicating individual appliance current draw, conductor run length and size.
      l. Complete sequence of operation.
   2. Prior to final acceptance, submit a letter confirming that inspections have been completed and system is installed and functioning in accordance with Specifications. Include manufacturer representative's certification of installation and letter of warranty.
   3. Operation and Maintenance Manuals. Provide manuals containing the following:
      a. Catalog Cut Sheets
      b. System Components, Initiating Devices and Notification Appliances' Installation Sheets
      c. Manufacturer's Installation, Operation and Maintenance Manual
      d. Program Data File Printout
      e. Program Data File on Electronic Storage Media
      f. Record Drawings
      g. Record Drawings on Electronic Storage Media
      h. One year warranty agreement including parts and labor. Warranty period begins upon date of completion.
      i. Record of Completion
      j. Test Reports
k. Instruction Chart

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Division 28, Electronic Safety and Section 01400, Quality Control Requirements, Articles 1.12, 1.13, and 1.14.

B. In addition, meet City of San Ramon, California requirements, ordinances and amendments.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Division 28, Electronic Safety and Section 01740, Warranties/Guaranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Notification Appliance Circuit Panels:
   1. Same manufacturer as fire alarm control equipment.
   2. No substitutions permitted.

B. Manual Pull Stations:
   1. Same manufacturer as fire alarm control equipment.
   2. No substitutions permitted.

C. Rate-of-Rise and Fixed Temperature Heat Detectors:
   1. Same manufacturer as fire alarm control equipment.
   2. No substitutions permitted.

D. Photoelectric Type Detectors:
   1. Same manufacturer as fire alarm control equipment.
   2. No substitutions permitted.

E. Duct-Mounted Smoke Detectors:
   1. Same manufacturer as fire alarm control equipment.
   2. No substitutions permitted.

F. Relay Modules:
   1. Same manufacturer as fire alarm control equipment.
   2. No substitutions permitted.

G. Control Modules:
   1. Same manufacturer as fire alarm control equipment.
   2. No substitutions permitted.

H. Input Modules:
   1. Same manufacturer as fire alarm control equipment.
   2. No substitutions permitted.

I. Fault Isolation Modules:
1. Same manufacturer as fire alarm control equipment.
2. No substitutions permitted.

J. Combination Horn/Strobes:
1. Must be compatible with fire alarm control equipment and notification appliance circuit panels.
2. Same manufacturer as fire alarm control equipment.
3. Wheelock
4. No substitutions permitted.

K. Strobes:
1. Must be compatible with fire alarm control equipment and notification appliance circuit panels.
2. Same manufacturer as fire alarm control equipment.
3. Wheelock
4. No substitutions permitted.

L. Horns:
1. Must be compatible with fire alarm control equipment and notification appliance circuit panels.
2. Same manufacturer as fire alarm control equipment.
3. Wheelock
4. No substitutions permitted.

M. Miscellaneous Accessories:
1. Weatherproof/Surface Backboxes:
   a. Same manufacturer as fire alarm detection devices or notification appliances.
   b. Or equal.
2. Circuit Conductors:
   a. Allied Wire and Cable
   b. Belden
   c. CCI
   d. West Penn Wire
   e. Or equal.
3. Surge Protection:
   a. Ditek
   b. Transtector
   c. Or equal.
4. Batteries:
   a. Same manufacturer as fire alarm control equipment.
   b. Power-Sonic
   c. Werker
   d. Or equal.
5. Locks and Keys:
   a. Same manufacturer as fire alarm control equipment.
   b. Or equal.
N. Substitutions: For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with contract documents.

O. Equipment to be supplied by a certified manufacturer representative.

2.2 NOTIFICATION APPLIANCE CIRCUIT PANELS

A. Provide power supply(s), adequate to serve modules, remote annunciators, addressable devices, notification appliances and other connected devices or appliances.

B. Loss of normal and emergency power automatically causes system to transfer to battery power. Indicate battery power operation by yellow lamp and audible annunciation at control panel and remote annunciator panels. Upon return of 120VAC power, unit recharges batteries to full capacity and maintains battery on float charge. Provide trickle charge adequate capacity to maintain battery fully charged with automatic rate charge.

C. Provide batteries in locking cabinet manufactured for purpose.

2.3 MANUAL PULL STATIONS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Semi-flush, red finish, nongrasping operation; maximum pull strength as allowed per ADA criteria.

C. Stations do not allow closure without keyed reset.

2.4 RATE-OF-RISE AND FIXED TEMPERATURE HEAT DETECTORS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Responding to 15 degrees F temperature rise per minute and to 135 degrees F fixed temperature as required by space use.

C. Provide off-white, low-profile detectors.

2.5 PHOTOELECTRIC TYPE DETECTORS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Panel adjustable sensitivity, LED source, multiple cell, 360 degree smoke entry, visual latching operation indicator, insect screen, functional test switch, two-wire operation and vandal-resistant locking feature.
2.6 **DUCT-MOUNTED SMOKE DETECTORS**

A. Photoelectric type. Duct sampling tubes extending width of duct, visual indication of detector actuation, direct housing mount. Detector powered from control panel, power on indicator light. Detector rated for air velocity, humidity and temperature of duct and environment where installed.

2.7 **RELAY MODULES**

A. Signaling line circuit interface module that connects to other building systems for control of fire/life safety functions, e.g., air-handler shutdown, fire/smoke damper closure, elevator recall.

B. Module powered from control panel.

2.8 **CONTROL MODULES**

A. Signaling line circuit interface module that provides notification appliance circuits or system control outputs.

B. Module powered from control panel.

2.9 **INPUT MODULES**

A. Signaling line circuit interface module that provides initiating device circuits for connection to contact closure initiating devices.

B. Module powered from control panel.

2.10 **FAULT ISOLATION MODULES**

A. Signaling line circuit interface modules that provide isolation of wire-to-wire shorts on a signaling line circuit with automatic reconnection upon correction of short circuit.

B. Provide module with status indicator LED.

2.11 **COMBINATION HORN/STROBES**

A. Multi-candela, flush wall and ceiling mount, insect-proof.

B. Provide horn/strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating 75 cd minimum unless otherwise indicated on Drawings.

2.12 **STROBES**

A. Multi-candela, flush wall mount, insect-proof.

B. Provide strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating 75 cd minimum unless otherwise indicated on Drawings.
2.13 HORNS

A. Flush wall mount, insect-proof.

B. Provide horns that meet the latest requirements of NFPA 72.

2.14 MISCELLANEOUS ACCESSORIES

A. Circuit Conductors: Copper or optical fiber; color code and label. Type FPL, FPLR and FPLP as required by NEC. Minimum signaling line circuit and initiating device circuit wire size: AWG18. Minimum notification appliance circuit wire size: AWG14, or as approved by Engineer. Fiber optic cable as required by manufacturer.

B. Surge Protection: In accordance with IEEE C62.41 B3 combination waveform and NFPA 70; except for optical fiber conductors.

C. Batteries: Sealed lead acid type. Provide additional cabinet, if required due to space limitations in control panels.

D. Locks and Keys:
   1. Deliver keys to Owner.
   2. Provide same standard lock and key for each key operated switch and lockable panel and cabinet; provide five keys of each type.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain Architect's approval of locations of devices, appliances and annunciators before installation.

B. Circuits:
   1. Signaling Line Circuits (SLC): Class B
   2. Notification Appliance Circuits (NAC): Class B.

C. Spare Capacity:

D. Power Sources:
   1. Primary: Dedicated branch circuits of facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate fire alarm system under normal supervisory condition for 24 hours and operate alarm signals for five minutes at end of standby period.

E. Obtain approval of system design from AHJ prior to installation. Do not begin installation without approval from AHJ and submittal review comments from Engineer.
F. Install in accordance with applicable codes, NFPA 72, NFPA 70 and the Contract Documents.

G. In accordance with manufacturer's instructions, provide wiring, conduit and outlet boxes required for the erection of a complete system as described in these specifications, as shown on Drawings and as required by AHJ.

H. Conceal wiring, conduit, boxes and supports where installed in finished areas.

I. Provide raceway system for cabling concealed in walls and hard ceilings and in locations where cabling is exposed. Where exposed, provide surface raceway in finished areas and surface mounted EMT in non-finished areas.

J. Provide cabling and conduits system suitable for wet locations for below grade systems.

K. At junction boxes and termination points, provide identification tags on wires and cables.

L. Route wiring to avoid blocking access to equipment requiring service, access, or adjustment.

M. Existing Components:
   1. Existing Fire Alarm System: Maintain fully operational during construction in all areas except areas of remodel.
   2. Disable system only to make switchovers and connections.
      a. Notify Owner before partially or completely disabling system.
      b. Notify local fire service.
      c. Make notifications at least five working days in advance.
      d. Make temporary connections to maintain service in areas adjacent to work area.
   3. Provide fire watch in areas where the system is not functioning if required by the AHJ.
   4. Equipment Removal:
      a. Remove existing system after acceptance of new fire alarm system. Restore damaged surfaces.
      b. Package operational fire alarm and detection equipment that has been removed and deliver to Owner.
      c. Remove from site and legally dispose of remainder of existing material.
   5. On-Premises Supervising Station: Include, as part of this work, modifications necessary to existing supervising station to accommodate new fire alarm work.

N. Fire Safety Systems Interfaces:
   1. Provide conduit, wiring, boxes and terminations from fire alarm system to monitored components.
      a. Alarm Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:
         1) Fire sprinkler water flow switches.
         2) Other alarm inputs.
      b. Supervisory Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:
         1) Fire sprinkler water control valve tamper switches.
         2) Other supervisory inputs.
      c. Trouble Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:
1) Other trouble inputs.

2. Fire Safety Functions: Provide power and control conduit, wiring, boxes and terminations to power devices and interface to fire alarm system.
   a. Doors:
      1) Provide smoke detectors and addressable control relays to release magnetic hold open devices and roll-down fire doors and door locks. Verify requirements and quantities prior to bidding.
      2) Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door.
      3) Electronic Locks or Electromagnetic Door Locks on Egress Doors: Unlock smoke zone egress doors upon activation of any alarm initiating device or suppression system in smoke zone.
      4) Overhead Coiling Fire Doors: Release upon activation of smoke detectors on either side of door.
   b. HVAC Systems:
      1) Fire/Smoke Dampers and Smoke Dampers:
         a) Provide required smoke detectors, relays, wiring and the like.
         b) Connect control and power wiring to dampers per manufacturer's instructions.
         c) Verify quantities, location and requirements of dampers with Division 23, HVAC Drawings and Specifications and mechanical system installer.
      2) Air Moving Systems:
         a) Provide duct-mounted smoke detectors on air systems with air flow rates exceeding 2000 CFM. Coordinate with Division 23, HVAC.
         b) Install duct-mounted smoke detector(s) on supply side of air system.
         c) Provide control wiring from addressable relay contacts to air handling equipment controller. Connect to controller so that when duct-mounted smoke detector is activated, the air handling equipment is shut down.
         d) Provide duct-mounted smoke detectors rated for air velocity, temperature and humidity of duct. Verify quantities, locations and requirements with Division 23, HVAC Drawings and mechanical system installer.
         e) Where duct-mounted smoke detectors are mounted in inaccessible building void spaces provide access hatch. Provide access hatch with fire rating equivalent to rating of wall, ceiling, or shaft being penetrated.

O. Inspection and Testing for Completion:
   1. System testing and commissioning to be performed by a certified manufacturer representative.
   2. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
   3. Document audibility measurements and verify intelligibility for each space on record drawings.
   4. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction and adjustments.
   5. Provide tools, software and supplies required to accomplish inspection and testing.
6. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required to test system.

7. Correct defective work, adjust for proper operation and retest until entire system complies with Contract Documents.

8. Notify Owner seven days prior to beginning completion inspections and tests.

9. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

10. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   a. Record all system operations and malfunctions.
   b. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   c. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   d. At end of successful diagnostic period, complete and submit NFPA 72 "Inspection and Testing Form."

P. Closeout:
   1. Closeout Demonstration:
      a. Demonstrate proper operation of functions to Owner.
      b. Be prepared to conduct any of the required tests.
      c. Have at least one copy of operation and maintenance data, copy of project record drawings, input/output matrix and operator instruction chart(s) available during demonstration.
      d. Have authorized technical representative of control unit manufacturer present during demonstration.
      e. Demonstration may be combined with inspection and testing required by AHJ. Notify AHJ in time to schedule demonstration.
      f. Repeat demonstration until successful.
   2. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
      a. Specified diagnostic period without malfunction has been completed.
      b. Approved operating and maintenance data has been delivered.
      c. Spare parts, extra materials and tools have been delivered.
      d. All aspects of operation have been demonstrated to Architect.
      e. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
      f. Occupancy permit has been granted.

3.2 NOTIFICATION APPLIANCE CIRCUIT PANELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide notification appliance circuit panel power supplies with 120VAC dedicated circuit per NFPA requirements.

D. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.
3.3 MANUAL PULL STATIONS
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
   D. Provide protective guard where device is subject to abuse and where required by AHJ.

3.4 RATE-OF-RISE AND FIXED TEMPERATURE HEAT DETECTORS
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
   D. Provide protective guard where device is subject to abuse and where required by AHJ.

3.5 PHOTOLELECTRIC TYPE DETECTORS
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
   D. Provide protective guard where device is subject to abuse and where required by AHJ.

3.6 DUCT-MOUNTED SMOKE DETECTORS
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

3.7 RELAY MODULES
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
3.8 CONTROL MODULES
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

3.9 INPUT MODULES
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

3.10 FAULT ISOLATION MODULES
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
   D. Provide Fault Isolator Modules for signaling line circuit per code requirements and manufacturer instructions.

3.11 COMBINATION HORN/STROBES
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.
   D. Provide protective guard where device is subject to abuse and where required by AHJ.

3.12 STROBES
   A. Reference 3.01, General Installation Requirements.
   B. Install per manufacturer's instructions and recommendations.
   C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.
D. Provide wire guards or protective covers where device is subject to abuse and where required by AHJ.

3.13 HORNS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.

D. Provide protective guard where device is subject to abuse and where required by AHJ.

3.14 MISCELLANEOUS ACCESSORIES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Weatherproof/Surface Backboxes: Provide manufacturer's weatherproof backbox listed for use in areas where the device or appliance is subject to humidity in excess of listed rating. Provide manufacturer surface backboxes where devices cannot be installed recessed.

D. Circuit Conductors: Provide wiring to meet the requirements of national, state and local electrical codes. Provide color coded wiring as recommended and specified by the fire alarm and detection system manufacturer. Provide Type FPLR cable when in a riser application or FPLP cable when installed in plenums.

E. Surge Protection; Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral and 350 V(ac), line-to-line; do not use fuses.

END OF SECTION
SECTION 31 11 00
CLEARING & GRUBBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes all work necessary to successfully complete demolition, clearing & grubbing to prepare site for the phasing and new construction, including the following:
   1. Protecting existing trees and vegetation to remain.
   2. Trimming tree limbs and roots.
   3. Removing trees as designated.
   4. Clearing vegetation, debris, trash and other materials within limits indicated.
   5. Grubbing of vegetation within limits indicated.
   7. Removing above-grade site improvements within limits indicated.
   8. Disconnecting, capping or sealing, and abandoning site utilities in place.
   9. Disconnecting, capping or sealing, and removing site utilities.
  10. Disposing of objectionable material off site.
  11. Clean line saw cutting of existing asphalt pavement, concrete sidewalks, concrete curb/gutter, etc., as specified herein.
  13. Protection from injury or defacement of trees and other vegetation and objects to be preserved.
      a. Removal of surface debris and deleterious materials such as rubbish.
      b. Removal and stockpile of materials for landscaping use at approved location.
      c. Disposal of unwanted materials off site.

1.2 REGULATORY REQUIREMENTS

A. No burning shall be allowed.

B. Comply with the following California Code of Regulations:
   1. Title 8: CAL/OSHA, Chapter, Subchapter 4 – Construction Safety Orders
   2. Title 24: Part 2, California Building Code, Chapter 33, Protection of Pedestrian during Construction or Demolition.
3. Bay Area Air Quality Management District
4. Alameda County Water District, Standard Specification and Details.
5. County of Alameda County Public Works Department, Design Guidelines.

1.3 DEFINITIONS

B. CAL-OSHA: California Occupational Safety and Health Administration.
C. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2-inches in diameter; and free of weeds, roots, and other deleterious materials.
D. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain District's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS


1.6 QUALITY ASSURANCE

A. Do not remove or prune trees without first securing a permit from the appropriate agency.
B. Prune to the standards of the International Society of Arborists and to ANSI 300.

1.7 PROJECT CONDITIONS

A. Except for materials indicated to be stockpiled or to remain the District's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.
B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the District. Avoid damaging materials designated for salvage.
C. Unidentified Materials;
   1. If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents,
immediately report the discovery to the District.

2. If necessary, the District will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to structural backfill defined in Section 31 23 33 Utility Trenching and Backfill.
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain during construction.
   1. Restore damaged improvements to their original condition, as acceptable to the Engineer and/or District. Prior to restoration the contractor shall notify Engineer and/or District of the damaged improvements.

3.2 TREE PROTECTION

A. Erect and maintain temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.

B. Do not store construction materials, debris, or excavated material within drip line of remaining trees.

C. Do not permit vehicles or equipment within drip line of remaining trees.

D. Do not excavate within drip line of remaining trees, unless otherwise indicated.

E. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation edge as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently
relocated and covered with soil.

3. Coat cut faces of roots more than 1-1/2-inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.

4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

3.3 TREE PRUNING

A. Prune trees to balance the crown, and eliminate hazards. Perform main work to reduce sail effect through thinning, reducing end weights, shortening long heavy limbs, removing deadwood, weak limbs and sucker growth. Prune limbs back to an appropriate lateral branch.

B. Make final cuts at the outer edge of the branch collar in accordance with the arborist’s recommendations.

C. Perform pruning work in a safe and proper manner, adhering to CAL-OSHA and ANSI Standards.

3.4 ROOT PRUNING

A. Do not cut tree roots greater than 3-inch in diameter and less than 12-inches below ground level without approval of the District.

B. Cut tree roots cleanly, as far from the trunk as possible, and not underneath any area where walkways are to be constructed. Root pruning shall be to a depth of 18-inches.

C. Tree root prune using a Vermeer root-cutting machine. Obtain the District’s approval before using alternate equipment or techniques.

D. Complete tree root pruning prior to any excavation adjacent to the tree.

E. Do not expose tree roots to drying out. Cover root ends with soil or burlap and keep moist until the final backfill is completed.

3.5 TREE REMOVAL

A. Remove trees designated for removal prior to the construction of new improvements.

B. Perform tree removal work in a safe and proper manner, adhering to CAL-OSHA and ANSI Standards.

C. Remove or grind stumps to a minimum of 18-inches below finish subgrade. Remove surface roots to this depth within 24-inches of the tree trunk. Trees, plants and roots that are below proposed building footprint or slabs on grade shall be removed in its entirety.

3.6 RESTORATION

A. Restore damaged improvements to their original condition, as acceptable to the
B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, as directed by the District.

1. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.

2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the District. Clear and grub existing areas only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations.

3.7 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.

B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by District or others unless authorized in writing by the Owner, and then only after arranging to provide temporary utility services according to requirements indicated.

D. Coordinate utility interruptions with utility company affected.

E. Do not proceed with utility interruptions without the permission of the District and utility company affected. Notify District and utility company affected 14 working days prior to utility interruptions.

F. Excavate and remove underground utilities that are indicated to be removed.

G. Securely close ends of abandoned piping with tight fitting plug or wall of concrete minimum 6-inches thick. All abandoned piping shall be filled with a cementious material, such as controlled low strength material.

3.8 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

B. Remove trash, debris, logs, concrete, masonry and other waste materials.

C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

D. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18-inches below subgrade. Trees, plants and roots that are below proposed building footprint or slabs on grade shall be removed in its entirety.
E. Use only hand methods for grubbing within drip line of remaining trees.

3.9 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Remove trash, debris, weeds, roots, and other waste materials.

D. Stockpile topsoil materials designated to remain on site at a location approved by the District at a location away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust. Refer to the SWPPP as required.

E. Do not stockpile topsoil within drip line of remaining trees.

3.10 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.

C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark or edge, remove material to joint, mark or edge.

3.11 BACKFILL

A. Place and compact material in excavations and depressions remaining after site clearing in conformance with Section 31 23 33.

3.12 DISPOSAL

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner’s property.

3.13 TEMPORARY FACILITIES

A. Provide the following temporary facilities to facilitate the demolition operations, as necessary.

1. Temp Traffic Controls
2. Protection of Persons and Property
3. Protection of Utilities
4. Noise and Dust Abatement.
5. Clear and restore area to their original condition.
6. Protect survey markers and monuments, existing improvements, and adjacent structures from removal and damage.

3.14 CONSTRUCTION WASTE MANAGEMENT

A. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the General Contractor’s Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

END OF SECTION
SECTION 31 23 00
EXCAVATION AND FILL

PART 1 - GENERAL

1.1  SUMMARY

A. This Section describes the requirements for earthwork operation, as shown on the Drawings and specified:
   1. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for parking areas, walks, paths, and any other site improvements called for on the Plans.
      a. Aggregate base.
      b. Lime stabilization.
      c. Dispose off-site waste, excess or unsatisfactory material.

1.2  RELATED DOCUMENTS

A. Sacramento Standard Specification:
   1. Section 14, Earthwork
   2. Section 17, Aggregate Bases.
   3. Section 10, Lime Stabilization

1.3  RELATED SECTIONS

A. Section 31 11 00 – Clearing and Grubbing

1.4  REGULATORY REQUIREMENTS


B. Alameda District, Standard Specification and Details.

C. ASTM
   1. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
   2. D 1586, Method for Penetration Tests and Split-Barrel Sampling of Soils.
   3. D 2487, Classification of Soils for Engineering Purposes.

E. CAL/OSHA, Title 8.
F. “Geotechnical Investigation for Proposed New Tutorial Library Building Diablo Valley College – San Ramon Campus 1790 Watermill Road San Ramon, CA” by RMA Group

1.5 DEFINITIONS

A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.

B. Excavation: Removal of material encountered above subgrade elevations.
   1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans or authorized by the District’s Representative.
   2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions without authorization by the District’s Representative. Unauthorized excavation shall be without additional compensation.

C. Structural Backfill: Soil materials approved by the District’s Representative and used to fill excavations resulting from removal of existing below grade facilities, including trees.

D. Structural Fill: Soil materials approved by the District’s Representative and used to raise existing grades.

E. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾-cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base or topsoil materials.

H. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project. The District’s Representative will determine if a soil material is unsuitable.

I. Utilities: onsite underground pipes, conduits, ducts and cables.
1.6 SUBMITTALS


B. Submit material certificates signed by the material producer and the Contractor, certifying that each material item complies with, or exceeds the specified requirements.

1.7 QUALITY ASSURANCE

A. Conform all work and materials to the recommendations or requirements the District’s Representative.

B. Conform all work to the appropriate portion(s) of Sacramento Standard Specifications,

C. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

D. Excavate and backfill existing areas only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations. Backfill as necessary to achieve rough grade elevations as indicated per plan.

E. Perform excavation, filling, compaction and related earthwork under the observation of the District’s Representative. Materials placed without approval of the District’s Representative will be presumed to be defective and, at the discretion of the District’s Representative, shall be removed and replaced at no cost to the District. Notify the District’s Representative at least 24-hours prior to commencement of earthwork and at least 48 hours prior to testing.

F. The District’s Representative will perform observations and tests required to enable him to form an opinion of the acceptability of the Project earthwork. Correct earthwork that, in the opinion of the District’s Representative, does not meet the requirements of these Technical Specifications.

G. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces and shall replace portions that in the opinion of the District’s Representative have been displaced or are otherwise unsatisfactory due to the Contractor’s operations.

H. Do not mix or place cement treated base when the temperature is below is below 36 degrees F or when the ground is frozen.

I. Finish surface of material to be stabilized prior to lime treatment shall be as specified in Sacramento Standard Specifications and as required by these Technical Specifications.
J. Finish surface of the stabilized material after lime treatment shall be as specified in Sacramento Standard Specifications and as required by these Technical Specifications.

K. Identify and protect existing utilities.

L. Finish soil grade tolerance at completion of grading:
   1. Paved areas: +0.05
   2. Other areas: ±0.10 feet.

1.8 PROJECT CONDITIONS

A. Promptly notify the District and the District’s Representative of surface or subsurface conditions differing from those disclosed in conformance with Division 1 General Requirements.

B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

D. Temporarily stockpile fill material in an orderly and safe manner and in a location approved by the District.

E. Provide dust and noise control in conformance with Division 1 General Requirements.

F. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from on-site excavations.

B. Obtain approval of on-site soil materials and borrow materials to be used for structural fill or structural backfill from the District’s Representative.

C. On-Site Structural Fill and Structural Backfill: Soil or soil-rock mixture from on site excavations, free from organic matter or other deleterious substances. On-site structural fill and backfill shall not contain rocks or rock fragments over 3 inches in greatest dimension.

D. Imported Structural Fill and Structural Backfill: Conform to the requirements of on-site
structural fill. Material shall also be a non-expansive and predominantly granular soil or soil-rock mixture with plasticity index of 8 or less, has a liquid limit less than 25, and an R-Value of 25 or greater.

2.2 SOIL STERILANT

A. Commercial chemical for weed control, registered by EPA. Provide granular, liquid or wet-able powder form.

2.3 AGGREGATE BASE

   1. Class 2, 1-1/2-inch Maximum: Section 26-1.02A.
   2. Class 2, 3/4-inch Maximum: Section 26-1.02A.
   3. Class 3: Section 26-1.02B.

2.4 LIME STABILIZATION

A. Lime Treatment Material: Conform to Section 24-1.02 and 24-1.03 of Sacramento Standard Specifications and the Project Geotechnical Report.

PART 3 - EXECUTION

3.1 GENERAL

A. Conform to Section 14, Earthwork, Sacramento Standard Specifications as modified by the Contract Documents.

B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

C. The use of explosives will not be permitted.

3.2 CONTROL OF WATER AND DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.

B. Dewater during backfilling operation so that groundwater is maintained a least two feet below level of compaction effort.

C. Obtain the District’s Representative’s approval for proposed control of water and dewatering methods.

D. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
E. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.

F. Maintain dewatering system in place until dewatering is no longer required.

3.3 WET WEATHER CONDITIONS

A. Do not prepare subgrade, place or compact soil materials if above optimum moisture content.

B. If the District’s Representative allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the District’s Representative.

3.4 EXCAVATION

A. Excavate earth and rock to lines and grades shown on drawings as prepared by a licensed professional engineer and to the neat dimensions indicated on the Plans, required herein or as required to satisfactorily compact backfill.

B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.

C. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.

D. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.5 REMOVAL OF EXISTING FILLS AND UNSUITABLE MATERIAL

A. Over-excavate areas of existing fills and other unsuitable material encountered during mass grading as directed by the District's Representative.

B. Conform with Division 1 General Requirements.

3.6 GRADING

A. Uniformly grade the Project to meet existing conditions.

B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.

C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.7 SUBGRADE PREPARATION

A. Prepare subgrades under paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill. At least 6 inches of select material shall be placed beneath exterior flatwork and extend at least two feet beyond the slab edges.

B. Prepare subgrades for paved areas, curbs and gutters by plowing or scarifying surface
at least 9 inches in one lift below final subgrade elevations and 1-foot beyond edge of pavement unless specified otherwise by the District’s Representative. Uniformly moisture condition to obtain optimum moisture contents. Break clods and condition surface by harrowing or dry rolling. Remove boulders, hard ribs and solid rock. Prepare earth uniform for full depth and width of subgrade.

1. Surface soil that has a moisture content of less than 22 percent (average, approximate plastic limit of the soil) should be excavated, moisture-conditioned to at least three percent above optimum moisture content, and compacted to between 88 and 93 percent relative compaction to reduce its expansion potential; maximum depth of required excavation for moisture conditioning is about two feet.

C. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.

D. Obtain the District’s Representative’s approval of subgrades prior to placing pavement.

E. Subgrade preparation will not be required in areas where lime treatment is used.

3.8 PLACEMENT OF STRUCTURAL FILL

A. Obtain the District’s Representative’s approval of surface to receive structural fill prior to placement of structural fill material.

B. Place structural fill on prepared subgrade.

C. Spread structural fill material in uniform lifts not more than 8-inches in un-compacted thickness and compact.

D. Place structural fill material to suitable elevations above grade to provide for anticipated settlement and shrinkage.

E. Overbuild fill slopes, as required by the District’s Representative, to obtain required compaction. Remove excess material to lines and grades indicated.

F. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.

3.9 TEMPORARY AND PERMANENT SLOPES

A. Temporary slopes less than 10 feet high should be inclined no steeper than 1.5:1 (horizontal to vertical).

B. Shallow, permanent, cut and fill slopes shall be constructed no steeper than 2:1 (horizontal to vertical).

3.10 AGGREGATE BASE

A. Watering, Spreading and Compacting: Section 17 of Sacramento Standard Specifications.
3.11 LIME STABILIZATION

A. Performing the stabilization shall conform to Section 10 of Sacramento Standard Specifications and the following:
   1. Add lime in the amount specified by the District’s Representative.
   2. Lime treat subgrade soils from back of curb to back of curb to a depth specified by the District’s Representative.
   3. Mix in two mixing periods, both with the tines lowered to the same depth. Both mixing periods shall be monitored and verified by the District’s Representative. The second mixing shall occur at about 24 hours after the initial mixing.
   4. Compact and grade the lime mixed subgrade immediately after the second mixing.
   5. Compact the lime treated subgrade to 93 percent as determined by ASTM D1557.
   6. After application of the curing seal, do not allow traffic on the lime treated material for a period of 7 days in lieu of the 3 days specified in Section 10 of Sacramento Standard Specifications.
   7. Proof-roll the stabilized subgrade after compacting to confirm that a non-yielding surface has been achieved. Yielding areas, if any, shall be mitigated. Mitigation could consist of over-excavation, utilization of stabilization fabric, or chemical treatment. Each case shall be addressed individually in the field by the District’s Representative.

3.12 COMPACTION AND TESTING

A. Do not compact by ponding, flooding or jetting.
B. Compact soils at optimum water content. Aerate material if it is too wet. Add water to material if it is too dry. Thoroughly mix lifts before compaction to ensure uniform moisture distribution.
C. Perform compaction using rollers, pneumatic or vibratory compactors or other equipment and mechanical methods approved by the District’s Representative.
D. Compaction requirements:
   1. Compact structural fills less than 5-feet thick to 90 percent compaction.
   2. Compact structural fill 5-feet thick or greater to 95 percent compaction.
   3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 2-feet beyond pavement edges unless specified otherwise by the District’s Representative.
   4. Compact the upper 6-inches of subgrade soils under walks, structures and areas to receive structural fill to 90 percent compaction.
3.13 **SOIL STERILIZATION**

A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concreter pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.

B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.

C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

3.14 **DISPOSAL**

A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the District.

**END OF SECTION**
SECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping and associated structures.

1.2 SECTION EXCLUDES

A. Drainage fill material and placement around subdrains.

B. Trenching and backfill for other utilities such as underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc.

1.3 RELATED SECTIONS

1. Section 31 23 00 – Excavation and Fill.
2. Section 33 10 00 – Water Utilities.
3. Section 33 30 00 – Sanitary Sewerage Utilities.
4. Section 33 40 00 – Storm Drainage Utilities.

1.4 RELATED DOCUMENTS

A. ASTM:
1. C 33, Specification for Concrete Aggregates.
7. D 2487, Classification of Soils for Engineering Purposes.

B. California Code of Regulation Title 24, Part 2, California Building Code:
1. Chapter 11B – Accessibility to Public Buildings.
2. Chapter 33 – Site Work, Demolition and Construction.

C. Caltrans Standard Specifications:
1. Section 19, Earthwork.
2. Section 26, Aggregate Bases.
3. Section 68, Subsurface Drains.
4. Section 88, Engineering Fabrics.

D. CAL/OSHA, Title 8.
E. "Geotechnical Investigation for Proposed New Tutorial Library Building Diablo Valley College – San Ramon Campus 1790 Watermill Road San Ramon, CA" by RMA Group

1.5 DEFINITIONS
A. AC: Asphalt Concrete.
C. Bedding: Material from bottom of trench to bottom of pipe.
D. CDF: Controlled Density Fill.
E. DIP: Ductile Iron Pipe.
F. Initial Backfill: Material from bottom of pipe to 12-inches above top of pipe.
G. PCC: Portland Cement Concrete.
H. RCP: Reinforced Concrete Pipe.
I. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of ½ the outside diameter measured from the top or bottom of the pipe.
J. Subsequent Backfill: Material from 12-inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.
K. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans.
2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions. Unauthorized excavation shall be without additional compensation.
L. Utility Structures:
1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
2. Sanitary sewer manholes, vaults, etc.
3. Water vaults, etc.

1.6 SUBMITTALS
A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Product Data:
1. Grading and quality characteristics showing compliance with requirements for the Work.
2. Certify that material meets requirements of the Project.

C. Samples:
1. If required, provide 40-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material.
2. Provide materials from same source throughout work. Change of source requires approval of the Owner.
1.7 QUALITY ASSURANCE

A. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.

B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

C. Conform work to the requirements of the California Building Code.
   1. Section 1806A.11 – Pipe and Trenches.

1.8 PROJECT CONDITIONS

A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the construction documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.

B. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.

D. Provide dust and noise control in conformance with Section 02000, Supplemental General Requirements for Civil Improvements. Also see Division 1 General Requirements for Cleaning and Waste Management.

PART 2 - PRODUCTS

2.1 PIPE BEDDING AND INITIAL BACKFILL

A. ASTM D 2321, Class IA, IB or II.
   1. Clean and free of clay, silt or organic matter.

B. Permeable Material: Conform to Section 68-1.025 of Caltrans Standard Specifications, Class 2 permeable.

C. Class 2 Aggregate Base: Conform to Section 26 of Caltrans Standard Specifications, ¾-inch maximum. Material shall also be non-expansive and predominantly granular soil or soil-rock mixture “(percent of passing #200: 50 maximum, 5 minimum)” with plasticity index of 15 or less.


2.2 WARNING TAPE

A. See Section 33 10 00 – Water Utilities.
2.3 SUBSEQUENT BACKFILL
   A. Conform to on-site or imported structural backfill in Section 31 23 00 – Excavation and Fill.

2.4 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)
   A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8-inch top size. The 3/8-inch aggregate shall not comprise more than 30% of the total aggregate content.
   B. Cement: Conform to the standards as set forth in ASTM C-150, Type II Cement.
   C. Fly Ash: Conform to the standards as set forth in ASTM C-618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.
   D. Air Entraining Agent: Conform to the standards as set forth in ASTM C-260.
   E. Aggregates need not meet the standards as set forth in ASTM C-33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.
   F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.
   G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

2.5 CONCRETE STRUCTURE BEDDING AND BACKFILL
   A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill.
   B. Poured-in-Place Structures:
      1. Bedding: In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
      2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 23 00 – Excavation and Fill.

2.6 FILTER FABRIC
PART 3 - EXECUTION

3.1 TRENCHING AND EXCAVATION

A. Existing PCC or AC Areas: Cut PCC or AC to full depth at a minimum distance of 12-inches beyond the edge of the trench.

B. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.

C. Excavation Depth for Bedding: Minimum of 4-inches below bottom, except that bedding is not required for nominal pipe diameters of 2-inches or less.

D. Excavation Width at Springline of Pipe:
   1. Up to a nominal pipe diameter of 24-inches: Minimum of twice the outside pipe diameter.
   2. Nominal pipe diameter of 30-inches through 36-inches: Minimum of the outside pipe diameter plus 2-feet.
   3. Nominal pipe diameter of 42-inches through 60-inches: Minimum of the outside pipe diameter plus 3-feet.

E. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.

F. Comply with the Owner’s limitations on the amount of trench that is opened or partially opened at any one time. Do not leave trenches open overnight without the approval of the Owner.

G. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.

H. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

3.2 CONTROL OF WATER AND DEWATERING

A. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water

B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
C. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.

D. Maintain dewatering system in place until dewatering is no longer required.

### 3.3 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities

### 3.4 PIPE BEDDING

A. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 95% relative compaction unless specified otherwise on the. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of bedding material will not be permitted.

### 3.5 WARNING TAPE

A. Install in accordance with Section 33 10 00 – Water Utilities.

### 3.6 BACKFILLING

A. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12-inches above the top of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the. Compact by
pneumatic tampers or other mechanical means. Jetting or ponding of initial backfill material will not be permitted.

B. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, unless specified otherwise on the Plans. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of subsequent backfill material will not be permitted.

C. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe.

3.7 CLEANUP

A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.

B. See Section 01 74 00 – Refer to Division 1 General Requirements for Cleaning and Waste Management for further cleanup requirements.

END OF SECTION
SECTION 32 13 00

RIGID PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.

B. Form construction and use in placing portland cement concrete pavement.

C. Joints for portland cement concrete pavement.

D. Finishing portland cement concrete pavement.

E. Curing and protecting portland cement concrete pavement.

1.2 RELATED SECTIONS

A. Section 31 31 19 – Vegetation Control.

B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

1.3 RELATED DOCUMENTS

A. AASHTO Standard Specifications
   1. T 53: Softening Point of Bitumen (Ring-and-Ball Apparatus).

B. ASTM Standards
   1. A 615: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   2. A 775: Epoxy Coated Reinforcing Steel Bars.
   3. A 934: Epoxy-Coated Prefabricated Steel Reinforcing Bars.
   6. D 2835: Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
   7. D 3405: Joint Sealants, Hot Poured, for Concrete and Asphalt Pavements.
   8. D 3963: Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel.

C. Caltrans Standard Specifications:
   1. Section 40, Portland Cement Concrete Pavement.
   2. Section 52, Reinforcement.
   3. Section 90, Portland Cement Concrete.
   4. Section 95, Epoxy.

D. Caltrans Standard Plans:
2. Plan A35C: Portland Cement Concrete Pavement Joint and End Anchor Details.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer must be certified according to the National Ready Mix Concrete Plant Certification Program.
B. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer’s plant and each aggregate from one source.

1.6 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
   1. Cementitious materials and aggregates.
   2. Steel reinforcement and reinforcement accessories.
   3. Admixtures.
   4. Curing compound.
   5. Applied finish material.
   7. Joint filler.
   10. Epoxy.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

A. General: Conform to Caltrans Standard Specifications, Section 90. Use Class 2 Concrete.
2.2 TIE BARS

A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A 615/A (615M), Grade 40 or 60 (Grade 300 or 420).

B. Epoxy-coat in conformance with the provisions in Section 52-1.02B of Caltrans Standard Specifications, except that references made to ASTM Designation D 3963/D 3963M shall be deemed to mean ASTM Designation A 934/A 934M or A 775/775M.

C. Do not bend tie bars.

2.3 EPOXY

A. Bond tie bars to existing concrete with epoxy resin conforming to Section 95-2.03, "Epoxy Resin Adhesive for Bonding New Concrete to Old Concrete," of the Caltrans Standard Specifications.

2.4 SILICONE JOINT SEALANT

A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile stress, 150% elongation, 7-day cure at 25° ± 1°C and 45% to 55% R.H.</td>
<td>ASTM D 412 (Die C)</td>
<td>310 kPa max.</td>
</tr>
<tr>
<td>Flow at 25° ± 1°C</td>
<td>ASTM C 639a</td>
<td>Shall not flow from channel</td>
</tr>
<tr>
<td>Extrusion Rate at 25° ± 1°C</td>
<td>ASTM C 603b</td>
<td>75-250 g/min.</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>ASTM D 792 Method A</td>
<td>1.01 to 1.51</td>
</tr>
<tr>
<td>Durometer Hardness, at -18°C, Shore A, cured 7 days at 25° ± 1°C</td>
<td>ASTM C 661</td>
<td>10 to 25</td>
</tr>
<tr>
<td>Ozone and Ultraviolet Resistance, after 5000 hours</td>
<td>ASTM C 793</td>
<td>No chalking, cracking or bond loss</td>
</tr>
<tr>
<td>Tack free at 25° ± 1°C and 45% to 55% R.H.</td>
<td>ASTM C 679</td>
<td>Less than 75 minutes</td>
</tr>
<tr>
<td>Elongation, 7 day cure at 25° ± 1°C and 45% to 55% R.H.</td>
<td>ASTM D 412 (Die C)</td>
<td>500 percent min.</td>
</tr>
<tr>
<td>Set to Touch, at 25° ± 1°C and 45% to 55% R.H.</td>
<td>ASTM D 1640</td>
<td>Less than 75 minutes</td>
</tr>
<tr>
<td>Shelf Life, from date of shipment</td>
<td>—</td>
<td>6 months min.</td>
</tr>
<tr>
<td>Bond, to concrete mortar-concrete briquets, air cured 7 days at 25° ± 1°C</td>
<td>AASHTO T 132c</td>
<td>345 kPa min.</td>
</tr>
</tbody>
</table>
Notes:

ASTM Designation: C 639 Modified (15 percent slope channel A).
ASTM Designation: C 603, through 3-mm opening at 345 kPa.
Mold briquets in conformance with the requirements in AASHTO Designation: T 132, sawed in half and bonded with a 1.5 mm maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T 132. Briquets shall be dried to constant mass at 100 ± 5°C.
Movement Capability and Adhesion: Prepare 305 mm x 25 mm x 75 mm concrete blocks in conformance with the requirements in ASTM Designation: C 719. A sawed face shall be used for bond surface. Seal 50 mm of block leaving 12.5 mm on each end of specimen unsealed. The depth of sealant shall be 9.5 mm and the width 12.5 mm.

e. R.H. equals relative humidity.

B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.

C. Furnish to the Owner a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

2.5 ASPHALT RUBBER JOINT SEALANT

A. Conform to the requirements of ASTM Designation: D 3405 as modified herein or to the following:
   1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that 100 percent will pass a 2.36-mm sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.
   2. The Ring and Ball softening point shall be 57°C minimum, when tested in conformance with the requirements in AASHTO Designation: T 53.
   3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 204°C.

B. The penetration requirement of Section 4.2 of ASTM Designation: D 3405 do not apply. The required penetration at 25°C, 150g, 5s, shall not exceed 120.

C. The resilience requirement of Section 4.5 of ASTM Designation: D 3405 do not apply. The required resilience, when tested at 25°C, shall have a minimum of 50 percent recovery.

D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D 3405, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.
E. Heat and place in conformance with the manufacturer’s written instructions and the 
details shown on the plans. Provide manufacturer’s instructions to the Owner. Do not 
place when the pavement surface temperature is below 10°C.

2.6 PREFORMED COMPRESSION JOINT SEALANT

   1. Number of cells: 5 or 6.
   3. Install compression seals along with lubricant adhesive according to the 
      manufacturer’s recommendations. Submit manufacture’s recommendations to the 
      Owner’s Representative.

B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of 
   Compliance, storage instructions and precautionary instructions for use. Also submit the 
   manufacturer’s data sheet with installation instructions and recommended model or type 
   of preformed compression seal for the joint size and depth as shown on the plans. Show 
   evidence that the selected seal is being compressed at level between 20 and 50 percent 
   at all times for the joint width and depth shown on the plans.

2.7 BACKER RODS

A. Provide backer rods that have a diameter prior to placement at least 25 percent greater 
   than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell 
   polyethylene foam that is compatible with the joint sealant so that no bond, adverse 
   reaction occurs between the rod and sealant. In no case use a hot pour sealant that will 
   melt the backer rod. Submit a manufacturer’s data sheet verifying that the backer rod is 
   compatible with the sealant to be used.

PART 3 - EXECUTION

3.1 WATER SUPPLY

A. Conform to Section 40-1.02 of Caltrans Standard Specifications.

3.2 SUBGRADE

A. Conform to Section 40-1.04 of Caltrans Standard Specifications.

3.3 SOIL STERILANT

A. Furnish and apply to areas indicated in accordance with Section 31 31 19 – Vegetation 
   Control.

3.4 PLACING

A. Conform to Section 40-1.06 of Caltrans Standard Specifications.

3.5 SPREADING COMPACTING AND SHAPING

A. Conform to Section 40-1.07 of Caltrans Standard Specifications.

3.6 INSTALLING TIE BARS

A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 15 meters. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.

B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:

1. Drilling and bonding in conformance with the details shown on the plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C 881, Type V, Grade 3 (Non-Sagging), Class shall be as follows:

<table>
<thead>
<tr>
<th>Temperature of Concrete</th>
<th>Required Class of Epoxy Resin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower than 40°F (4.5°C)</td>
<td>A</td>
</tr>
<tr>
<td>40°F (4.5°C) through 60°F (15.5°C)</td>
<td>B</td>
</tr>
<tr>
<td>Above 60°F (15.5°C)</td>
<td>C</td>
</tr>
</tbody>
</table>

2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Owner, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Owner, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.

3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.

4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

3.7 JOINTS

A. Conform to Section 40-1.08 of Caltrans Standard Specifications, Except that tie bars shall be as specified under Part 2, Products.

1. Transverse Contact Joints: Section 40-1.08A of Caltrans Standard Specifications.
(a) Construct a transverse contact (construction) joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.

(b) If sufficient concrete has not been mixed to form a slab to match the next weakened plane joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall become the property of the Contractor and shall be properly disposed of.

(c) A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.

2. Weakened Plane Joints: Section 40-1.08B, except that the insert method of forming joints in pavement shall not be used.

3.8 FINISHING

A. Conform to Sections 40-1.09 and 40-1.10 of Caltrans Standard Specifications.

3.9 CURING

A. Conform to Section 40-1.11 of Caltrans Standard Specifications.

3.10 SEALING JOINTS

A. Liquid Joint Sealant Installation.

1. The joint sealant detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the plans.

2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.

3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 6 ± 1 mm and a minimum pressure of 0.62-MPa.

4. Install backer rod as shown on the plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 4°C or above. Install backer rod
when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.

5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the plans.

6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.

7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

B. Preformed Compression Joint Seal Installation

1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the plans.

2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.

3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 6 ± 1 mm and a minimum pressure of 0.62-MPa.

3.11 PROTECTING CONCRETE PAVEMENT

A. Conform to Section 40-1.12 of Caltrans Standard Specifications.
SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Materials for Portland cement concrete.
B. Aggregate and aggregate grading for Portland cement concrete.
C. Water for Portland cement concrete.
D. Admixtures for Portland cement concrete.
E. Proportioning for Portland cement concrete.
F. Mixing and transporting Portland cement concrete.
G. Formwork for cast in place Portland cement concrete.
H. Embedded materials for Portland cement concrete.
I. Steel reinforcement for Portland cement concrete.
J. Placing and finishing Portland cement concrete.
K. Curing Portland cement concrete.
L. Protecting Portland cement concrete.

1.2 RELATED SECTIONS

A. Section 31 11 00, Clearing and Grubbing

1.3 RELATED DOCUMENTS

A. ASTM:
   1. A 82, Cold Drawn Steel Wire for Concrete Reinforcement.
   2. A 185, Steel Welded Wire Fabric, Plain for Concrete Reinforcement.
   3. A 615, Deformed and Plain Billet Steel Bars, for Concrete Reinforcement.
7. C 618, Fly Ash and Raw or Calcined Natural Pozzolan for use as Natural Admixture in Portland Cement.

B. Sacramento Standard Specifications:
   1. Section 20: Concrete Structures.
   2. Section 24: Concrete Curbs and Sidewalks.

1.4 DEFINITIONS
A. ASTM: American Society for Testing Materials

1.5 SUBMITTALS
A. Submittal procedure shall be as outlined in Division 1 – General Requirements.
B. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.6 QUALITY ASSURANCE
A. Concrete shall be subject to quality assurance in accordance with Sacramento Standard Specifications.
   1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slab on grade.
B. Certifications:
   1. Provide Owner’s Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
      a. Materials contained comply with the requirements of the Contract Documents in all respects.
      b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Sacramento Standard Specifications and produces the required compressive strength under like conditions.
      c. Statement of type and amount of any admixtures.
   2. Provide Owner’s Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case
of transit mixers.

C. Conform to the applicable provisions of the Sacramento Standard Specification and these Technical Specifications.
   1. Conform construction of Portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks, pads) to the requirements of the Sacramento Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
   2. Conform other construction of Portland cement concrete items to the requirements of the Sacramento Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.

1.7 DESIGNATION

A. General: Whenever the 28-day compressive strength is designated herein or on the Plans is a 3,600psi or greater, the concrete shall considered to be designated by compressive strength. The 28-day compressive strength shown herein or on the plans which are less than a 3,600psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in the Sacramento Standard Specifications.

B. Unless noted otherwise herein or on the Plans, the minimum compressive strength for portland cement concrete at 28 days for this Project shall be 3,600 psi.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT

A. General: Type II (modified) cement conforming to Sacramento Standard Specifications.

B. Provide a coloring equivalent to ¼ pound of lampblack per cubic yard. Add to the concrete at the central mixing plant. Liquiblack, as supplied by Concrete Corporation of Redwood City, California, may be used in lieu of lampblack. One pint of liquiblack shall be considered equal to one pound of lampblack.

2.2 AGGREGATE AND AGGREGATE GRADING

A. General: Conform to the requirements of Section 90-2.02, 2.02A and 2.02B of the Sacramento Standard Specifications.

B. Aggregate Size and Gradation: Conform to the requirements of Section 90-3 of the Sacramento Standard Specifications for 1-inch maximum combined aggregate.
2.3 WATER

A. General: Conform to the requirements of the Sacramento Standard Specifications. For mixing and curing Portland cement concrete and for washing aggregates.

2.4 EXPANSION JOINT MATERIAL

A. Material for expansion joints in Portland cement concrete improvements shall be pre-molded expansion joint fillers conforming to the requirements of ASTM Designation D 1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
   2. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½-inch.
   3. Structures: As indicated.

2.5 REINFORCEMENT AND DOWELS

A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.

B. Slip dowels, where noted or called for on the plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.

C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM Designation A 82 for the material and ASTM Designation A 185 for the mesh. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.

D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM Designation A 82.

E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.6 COLOR AND PATTERN FOR DECORATIVE SURFACES
A. Colors for decorative surfacing shall be CHROMIX admixtures as manufactured by the L. M. Scofield Company, Schedule A-312.05 or approved equal. The specific color shall be as designated or called for on the Plans.

B. Patterns for decorative surfacing shall be standard "Bomanite" patterns as copyrighted by the Bomanite Corporation of Palo Alto, California or equal. The specific pattern shall be as designated or called for on the Plans.

2.7 ACCESSORY MATERIALS

A. Conform water stops and other items required to be embedded in of portland cement concrete structures to the applicable requirements of the Sacramento Standard Specifications unless otherwise specifically noted or called for on the Plans or detail drawings.

B. Curing Compounds:
   1. Regular Portland Cement Concrete: "Non-Pigmented Curing Compound - Chlorinated Rubber Base-Clear" conforming to the requirements contained in the Sacramento Standard Specifications.
   2. Color Conditioned Decorative Portland Cement Concrete: LITHOCHROME colorwax as manufactured by the L. M. Scofield Company or approved equal.

2.8 FORMS

A. Conform to the requirements of the Sacramento Standard Specifications.

2.9 PRECAST CONCRETE STRUCTURES

A. Conform to the following Sections of Sacramento Standard Specifications:
   1. Section 20, Concrete Structures.

2.10 PORTLAND CEMENT CONCRETE PAVEMENT

A. General: See Section 02751.

PART 3 - EXECUTION

3.1 STRUCTURAL EXCAVATION

A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density.

C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site, if the material is approved by the Geotechnical Consultant.

3.2 SOIL STERILANT

A. Furnish and apply to areas indicated in accordance with Section 31 23 00, Excavation and Fill.

3.3 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner’s Representative, submit details and calculations to the Owner’s Representative. The Owner’s Representative may forward the submittal to the Geotechnical Consultant, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor’s submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner’s Representative.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.4 PLACING CONCRETE FORMS

A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.

B. Thoroughly clean all forms prior to placement and coat forms with approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.

C. Carefully set forms to the alignment and grade established and conform to the required
dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.

D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.5 PLACING STEEL REINFORCEMENT

A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
   1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
   2. Splice locations shall be made as indicated on the plans.

B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.

C. Place reinforcing to provide the following minimum concrete cover:
   1. Surfaces exposed to water: 4-inches.
   2. Surfaces poured against earth: 3-inches.
   3. Formed surfaces exposed to earth or weather: 2-inches.
   4. Slabs, walls, not exposed to weather or earth: 1-inch.

D. Minimum spacing, center of parallel bars shall be two and one half (2-1/2) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.6 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

A. Transit mix concrete in accordance with the requirements of ASTM Designation C 94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the Owner’s Representative.

B. Do not hand mix concrete for use in concrete structures.
3.7 PLACING PORTLAND CEMENT CONCRETE

A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.

B. Do not place concrete until the subgrade and the forms have been approved.

C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.

D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner’s Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.

E. Concrete in certain locations may be pumped into place upon prior approval by the Owner’s Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.8 PLACING ACCESSORY MATERIALS

A. Place water stops and other items required to be embedded in of Portland cement concrete structures at locations shown or required in accordance with Section 51 of the Sacramento Standard Specifications unless otherwise specifically noted or called for on the Plans.

B. Curing Compounds:
1. Regular Portland Cement Concrete: Apply "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" in accordance with the Sacramento Standard Specifications.
2. Color Conditioned Decorative Portland Cement Concrete: Apply LITHOCHROME colorwax in accordance with the manufactures instructions.

3.9 EXPANSION JOINTS

A. Construct expansion joints incorporating pre-molded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, sidewalks, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch (1/2" x 12") smooth slip dowels in the positions shown or noted on the detail drawings.

B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.
3.10 WEAKENED PLANE JOINTS

A. Construct weakened plane joints in concrete curbs, gutters, sidewalks, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.

1. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8-inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form weakened plane joints with power saws equipped with shatterproof abrasive or diamond-rimed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade or otherwise damage surface and before concrete develops random contraction cracks.

3.11 FORM REMOVAL

A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.

B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.

C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.

D. Leave edge forms in place at least 24 hours after pouring.

3.12 CONSTRUCTION

A. Form, place and finish concrete curbs, walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of Section 73-1.04, 73-1.05, 72-1.05A and 73-1.06 of the Sacramento Standard Specifications as modified herein.

B. Provide a medium broom finish to all horizontal surfaces unless otherwise shown.

C. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12-inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6-inch deep lift of asphalt concrete after gutter form is removed.

D. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.

3.13 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

A. New curb, gutter, or sidewalk is to connect to existing improvements to remain by saw
cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½-inch diameter by 12-inch long dowels at 24-inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.

B. A cold joint to the existing curb is not acceptable.

3.14 DECORATIVE AND NON-DECORATIVE SURFACING CONSTRUCTION

A. Decorative surfacing concrete walks, concrete median islands or other installations shall be formed and placed as a concrete slab conforming to the details shown or noted on the Plans.

B. Add lampblack or equivalent to the non-decorative surface concrete at the central mixing plant.

3.15 FIELD QUALITY CONTROL

A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.

B. No concrete shall be placed prior to approval of forms.

C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.

D. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.

E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Sections 73-1.05 and/or 73-1.06 of the Sacramento Standard Specifications.

3.16 RESTORATION OF EXISTING IMPROVEMENTS

A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.

B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION
SECTION 32 13 16
LANDSCAPE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes specially colored and finished landscape concrete and appurtenances, including but not limited to:
1. Broom finish concrete paving.
2. Sandblast finish concrete.
3. Miscellaneous concrete, including footings.

B. Concrete shall be colored where shown; standard gray elsewhere.

1.2 RELATED SECTIONS

A. Concrete - Division 3.
B. Portland cement concrete paving - Section 03 33 01.
C. Sealants: Section 07 90 00.
D. Dampproofing: Section 07 92 00.

1.3 SUBMITTALS

A. Product data: Submit manufacturer's specifications, installation instructions and catalog cuts for all materials.

B. Shop drawings:
   1. Show detailed construction and location of construction and expansion joints and scoring which deviate from drawings.

C. Where slip resistance is specified for paving, submit results of coefficient of friction tests per ASTM C 1028, if requested by Architect.

1.4 QUALITY ASSURANCE

A. As specified in Division 3.

B. Field samples: Anticipate that up to 2 samples of each type of concrete may be required to establish accepted colors and finishes.
   1. Cast samples from accepted materials identical to those to be used on site.
   2. Cast 2 x 2 foot x 2 inch thick samples as follows:
a. Integrally colored, light sandblast finish concrete.
b. Integrally colored, light broom finish concrete: Representative sample of each color.
c. Standard gray, medium sandblast finish concrete.
d. Non-shrink grout: Sample of each color (2 inches square), demonstrating match with accepted concrete samples.

3. Owner’s Representative will review and accept samples for finish appearance. Refabricate samples until accepted. Accepted samples shall serve as standard for subsequent work.

4. After acceptance, sawcut two 1 foot squares from edge of samples for Owner’s Representative use. Retain balance of sample at project site.

5. Remove and dispose of samples when directed by Owner’s Representative.

C. Mockups:
   1. Construct mockups where directed by Owner’s Representative, from accepted materials identical to those to be used on project.
   2. Cast 8 foot square sample of paving of each type, showing each color and finish, edge treatment, and expansion joint with sealant. Include minimum 4 foot long section of paving band.
   3. Test accepted sealer on each mockup as directed by Owner’s Representative.
   4. Demolish and remove mockups when directed by Owner’s Representative, unless otherwise shown.

1.5 COORDINATION

A. Coordinate delivery and installation of embedded items and installation of sleeves.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS, REINFORCING, AND FORMWORK:
Conforming to Division 3, with additional requirements as specified herein.


B. Do not use materials or products containing calcium chloride.

C. Sources for concrete materials shall be consistent throughout Work.

2.2 MIXES:

A. Landscape concrete shall meet requirements of Division 3 unless otherwise shown.
   1. Minimum compressive strength: 3,000 psi.
2.3 **DRY-SHAKE COLOR HARDENER**

   A. Packaged dry combination of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Coloring pigments shall be finely ground nonfading mineral oxides interground with cement. Color: As selected by Owner’s Representative from manufacturer’s standard colors; as accepted.

   B. Acceptable products: Lithocrome Color Hardener; L.M. Scofield Co.; Colorcron; Master Builders, Inc.; or accepted equal.

2.4 **INTEGRAL COLOR**

   A. Water-reducing, set-controlling admixture; Chromix Admixture, L.M. Scofield Co., Los Angeles, CA, or approved equal.

   B. Color: To be selected from manufacturer’s standard colors, as accepted.

2.5 **OTHER MATERIALS:**

   A. Expansion joint filler: As specified in Section 07900 - Sealants.

   B. Grout for concrete exposed to view in the finished work: Non-metallic, non-shrink. Color and texture when fully cured shall match adjacent concrete. Five star grout #130, Five Star Products Co, Fairfield, CT or approved equal.

   1. Coloring agent: Iron oxide pigments as recommended by grout manufacturer. Davis Colors, Los Angeles, CA; L.M. Scofield; or approved equal.

   C. Curing material: When Chromix integral color concrete admixture from L. M. Scofield is used in colored landscape concrete provide Lithichrome Colorwax as curing agent. Install curing agent per the manufacturers recommendations. L.M. Scofield Co., Los Angeles, CA, or approved equal.

   D. Stair nosing warning strips: Extruded aluminum channel, Type 6063-T5 with uniform integrally colored, minimum 65 percent aluminum oxide/silicon carbide anti-slip filler, and embedded aluminum anchor, 3 inch width. Color as selected by Architect from manufacturer’s standard colors. Supergrit Safety treads, Type 231 with Sure-hold anchor; Wooster Products Co, Wooster, OH or approved equal.


   1. Colored concrete: Lithium quartz sealer; No. HLQ 125.

3. Manufactured by Sinak Corporation, San Diego, CA or accepted equal. Available from The Burke Company, Oakland, CA.

F. Sealant: Meeting requirements of Standard Specifications; self-leveling, traffic grade polyurethane sealant. Color to match concrete paving, as accepted.

G. Surface retarder: Lithotex Top Surface Retarder; L.M. Scofield; or accepted equal.

PART 3 - EXECUTION

3.1 GENERAL: As specified in Division 3, with additional requirements as specified herein.

A. Curb and gutter shall match color of adjacent paving as shown. **Delete if no special curb and gutter.**

3.2 LAYOUT:

A. Architect will review layout of forms. Adjust alignment as directed until accepted.

3.3 PREPARATION:

A. Prepare subgrade as shown and specified.

3.4 TOLERANCES:

A. Maximum variation from true plane of overall surface:
   1. Float finish: 1/4 inch in 10 feet.
   2. Trowel finish: 1/8 inch in 10 feet.
   5. Rubbed finish: 1/8 inch in 10 feet.
   6. Acid etch finish: 1/8 inch in 10 feet.
   7. Retarded washed aggregate finish: 1/4 inch in 10 feet.

B. Surfaces, including tops of walls, shall be free of depressions and abrupt transitions. At no point shall surface fail to drain.

3.5 DRY-SHAKE COLOR HARDENER:

A. According to manufacturer’s instructions and recommendations.

B. Make 2 applications, wood floating after each application, at rate of _____ pounds per 100 sq. ft. Mask adjacent surfaces.

C. Color and finish shall match accepted samples and mockups.
3.6 **FINISHES:**

A. **Float finish:**
   1. For slabs to receive trowel finish or stamped finish.
   2. Surface shall be uniform, free of high and low spots, and sloped to drain as shown on Drawings.

B. **Trowel finish:** Shall be uniform, smooth and sloped to drain.

C. **Smooth formed finish (exposed):**
   1. For vertical concrete surfaces exposed to view, to be sandblasted or rubbed.
   2. Shall have surface finish imparted by overlay plywood.
   3. Patch defects as specified. Completely remove fins and projections.
   4. Horizontal surfaces: Texture to match adjacent formed surface. At Contractor's option, magnesium float or steel trowel finish.

D. **Sandblast finish:**
   1. Provide light sandblast finish where shown, to match accepted samples.
   2. Apply to trowel finish on flatwork.
   3. Sandblast finish paving shall have a static coefficient of friction of 0.8 or greater when wet.

E. **Broom finish:**
   1. Provide light medium broom finish where shown, to match accepted sample.
   2. Apply to trowel finish on flatwork.
   3. Score surface with nylon bristle broom, to form uniform impression perpendicular to direction of traffic.

F. **Acid etched finish:**
   1. Apply trowel finish and scored pattern. Do not use curing compounds on concrete to receive acid etch finish.
   2. When concrete is fully cured, flood surface with water.
   3. Apply 30 percent muriatic acid solution, and scrub with nylon broom to achieve approved degree of etch.
   4. Neutralize acid with solution in proportion of 1/4 - 1/2 pound of baking soda to 5 gallons of water.
   5. Vacuum surface to remove solution. Rinse and let dry.
   6. Sealer: As recommended by manufacturer, to match accepted sample.
   7. Finished surface shall match accepted samples and mockups, and have a static coefficient of friction of 0.8 or greater when wet.
   8. Prevent contamination of planting areas and damage to adjacent surfaces.

3.7 **JOINTS AND EDGES:**

A. Submit shop drawings showing locations and detailing of construction joints if required.
B. Construct joints as shown. Crossing joints shall physically intersect.

C. Expansion joints:
   1. Provide as shown and wherever paving abuts curbs, walls or other structures, unless otherwise shown.
   2. Clean expansion joints after curing and fill with specified joint sealant flush with adjacent paving.
   3. Joints in topping slab shall align with joints in subslab.

D. Tool slab edges, edges of expansion joints, and tooled joints before and after finishing, to form smooth uniform impression.

3.8 CURING

A. As specified in Division 3.

B. Do not use curing compound on surfaces to receive acid etch finish.

3.9 REPAIRING AND PATCHING:

A. Defective concrete shall be removed and replaced at Contractor's expense unless it can be repaired to original specifications.

B. Patch and repair cracks, rock pockets, spalling, voids, variations in color and texture, and discolorations that cannot be removed by cleaning.

C. Repairs shall match adjacent finishes and accepted samples and mock-ups, and shall meet approval of Architect.

3.10 CLEANING:

A. Clean exposed surfaces to remove clouding and provide uniform appearance when dry.

B. Apply sealer to all exposed concrete surfaces, as recommended by sealer manufacturer.
   1. Do not use sodium silicate products on colored concrete.

END OF SECTION
SECTION 32 84 00

IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes providing complete irrigation system. Work includes but is not limited to:
   1. Trenching, stockpiling excavated materials and backfilling trenches.
   2. Controller.
   3. Connection to water supply.
   4. Piping; valves; sleeves and conduit (including sizing); and fittings.
   5. Sprinkler heads and emitters.
   6. Replacement of unsatisfactory work.
   7. Clean-up, inspection and acceptance.
   8. Tests, record drawings and submittals.
   9. Permits, fees and inspections.

B. Related Sections:
   1. Final Acceptance for Work of this Section is contingent on completion of Work of Section 32 90 00.
   2. Electrical power to controller: Division 16.

1.2 SUBMITTALS

A. Procedures: In accordance with Section 01 33 00.

B. Materials list: Submit complete materials list. Include manufacturer, model number and description of all materials and equipment. Include sealants, cements, lubricants and other proprietary items.

C. Shop drawings: Submit for all assemblies not detailed on the Drawings. Include mounting details for rain shutoff.

D. Record drawings: Submit as specified, within 10 working days after start of Maintenance Period.
   1. Show every change from Contract Drawings and Specifications and exact as-built locations, sizes and kinds of equipment.
   2. Dimension from 2 permanent points of reference such as building corners, sidewalks, road intersections or monuments the following items:
      a. Connection to water source.
      b. Ball valves.
      c. Routing of pressure lines.
d. Remote control valves.
e. Quick coupling valves.
f. Other equipment as directed by Owner’s Representative.

3. Delivery of Record Documents shall not relieve Contractor of the responsibility of furnishing required information that may be omitted from Record Documents.

E. Operation and maintenance manuals: Deliver to Owner’s Representative at least 10 days before completion of construction, 2 complete sets of the following data. Data shall be on 8 1/2 inch by 11 inch sheets, in 3-ring binder. Include:
1. Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representatives.
2. Catalog and parts sheets on all material and equipment installed under this Section.
3. Complete operating and maintenance instructions for all equipment.
4. Complete and dated manufacturer's warranties for all materials used.

F. Special tools: Two sets of special tools as required to operate, adjust, dismantle or repair equipment. Include tools not normally found in possession of maintenance personnel.

G. Controller charts: Charts shall be the maximum size that the controller door will allow, showing areas covered by each controller. Color code area of coverage of each valve and enlarge valve sequence to be readable when drawing is reduced. Reduce approved record drawings and seal between two 20-mil plastic sheets.

1.3 QUALITY ASSURANCE

A. Comply with requirements of the Uniform Plumbing Code and the National Electrical Code.

1.4 WARRANTY

A. Provide 1 year guarantee for Work of this Section in accordance with Section 01 33 00.

B. Provide supplemental guarantee, on Contractor's letterhead:
1. Warrant that irrigation system has been installed according to Drawings and Specifications, and that system will be free of defects in products and installation for 1 year from Substantial Completion. Manufacturer's warranties shall only supplement special warranty.
2. Agree to repair or replace defective Work, or adjacent work which is damaged by such defects, with the exception of ordinary wear and tear, abuse or neglect. This includes damage to site improvements caused by settlement of improperly compacted trench backfill.
3. Owner reserves the right to make temporary repairs as required.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. Polyvinyl Chloride (PVC) Pipe: NSF approved, Type 1, Grade 1 PVC compound; ASTM D1784, ASTM D1785 and ASTM D2241. Pacific Western Extruded Plastics Co., Eugene, OR, or accepted equal.

B. Pipe shall bear the following markings:
   1. Manufacturer's name
   2. Nominal pipe size
   3. Schedule or class
   4. Pressure rating in PSI
   5. National Sanitation Foundation approval
   6. Date of extrusion.

C. Pressure main line pipe: 1120 PVC plastic pipe. Class 315 for 1 1/2 inch and larger; schedule 40 for 1 1/4 inch and smaller.

D. Lateral line pipe: 1120, schedule 40 PVC.

E. Sleeves (sizes to be determined by Contractor):
   1. Water lines 1120, schedule 40 PVC.
   2. Electrical lines: Gray, schedule 40 PVC conduit.

F. Fittings:
   1. Solvent weld socket fittings: Schedule 40, Type 1, Grade 1, NSF approved, ASTM D2466-90. Schedule 80, ASTM D2464. Fittings shall bear manufacturer's name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval. Lasco Products, Brownsville, TN, or accepted equal.
   2. Low VOC Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation methods recommended by pipe manufacturer. IPS Weld-On Corporation, Gardena, CA, or accepted equal.

G. Polyvinyl chloride (PVC) pipe and fittings for above-grade installation: Brown colored schedule 40 PVC pipe, UV resistant per ASTM G53; NSF approved, Type 1, Grade 1 PVC compound conforming to ASTM resin specification D1784 and meeting Federal Specification PS-22-70. Shall conform to other requirements herein specified. Brownline, Brownline Pipe Co.; Solar Proof, Pacific Plastics, or approved equal.
1. **Pipe stabilizer**: Recommended by pipe manufacturer, as required to secure pipe to slope.

### 2.2 OTHER PIPING MATERIALS

**A.** Pipe upstream of (backflow preventer/master valve): Schedule 40 galvanized steel. (Copper tube, Type K)

**B.** Pipe wrapping tape:

1. **Metal pipe**: 2 inch wide, 20 mils thick, black PVC all weather corrosion-resistant tape with high tack adhesive formulated to resist corrosion. Use same manufacturer's pipe primer to seal pipe and prepare for tape wrapping.
2. **PVC pipe**: As above, except primer is not required.

**C.** Pipe joint compound: Non-hardening, non-toxic, designed specifically for use on PVC and metal threaded connections in water carrying pipe. As recommended by pipe manufacturer and accepted by Owner’s Representative.

**D.** Flexible riser/connector: EPDM hose, PVC ends, with stainless steel bands. Flex-Riser, King Brothers Industries, Valencia, CA or accepted equal.

**E.** In-line check valve (if required): Sch. 80 PVC with stainless steel springs, adjustable from 12 to 32 feet of head. KBI Adjustable Check Valve, King Brothers Industries, or accepted equal. **Provide UV resistant check valve above grade.**

**F.** Provide dielectric fittings where dissimilar metals come into contact.

### 2.3 VALVES

**A.** Gate valves: Brass construction, screwed connections, with teflon seats and standard port. Nibco T-113 series, Nibco Industries, Elkhart, IN; or accepted equal.

**B.** Plastic electric remote control valve:

1. **Globe pattern;** heavy-duty, glass-filled, UV resistant nylon body and bonnet, stainless steel fasteners, nylon-reinforced rubber diaphragm.
2. **Normally closed with manual internal bleed double filtered pilot flow.** All internal parts shall be removable from top.
3. **Rated to 150 psi.** Flow rate: 2 - 150 gpm with max 2.4 psi pressure loss.
4. **24 VAC solenoid actuated.**
5. **PGA Series with PRS-B pressure regulating module, Rainbird, Inc., Glendora, CA or accepted equal.** Rainbird, Inc., Glendora, CA or accepted equal.

**C.** Quick coupling valves: Bronze construction, 1-inch connection, two-piece body, yellow vinyl locking top, single slot and lug. Size: 1 inch. 1 inch FIPT outlet. Model No. 44LRC; Rainbird Inc., Glendora, CA; or accepted equal.
2.4 VALVE BOXES

A. HDPE, green, UV resistant, with stainless steel bolt-down mechanism and heat-branded letters, minimum 2 inch height. Carson Industries Inc., La Verne, CA or accepted equal.
   1. Remote control valves and gate valves: 12 x 18 inches, series 1419 B. Letters: "ICV" and the valve number.
   2. Quick coupling valve: Round, 10 inch diameter, series 910. Letters: "QCV".

B. Multi-outlet emitter: Plastic, approximately 6 inch diameter; Model #6303, Olsen Irrigation Systems; Santee, CA; Model 645 VBX Bubbler Access Box, PepCo Water Conservation Products, Inc., Fresno, CA; or accepted equal.

2.5 SPRINKLER HEADS

A. Spray sprinkler:
   1. Matched precipitation rate, seamless molded plastic, with stainless steel adjustment screw and retraction spring.
   2. Pressure activated wiper seal and removable flushing plug.
   3. Pop-up body shall have integral check valve capable of preventing low-head drainage up to 7 feet of head.
   4. Pop-up height: 6 inches.
   5. Nozzle: as shown on Drawings. Provide pressure compensating screen for 30 psi pressure regulation to nozzle where required to reduce radius or compensate for pressure variations.
   6. 570Z-COM series, The Toro Company, Riverside, CA, or accepted equal.

B. Gear driven rotor:
   1. Matched precipitation rate, seamless molded plastic, with stainless steel adjustment screw, locking rubber cover, and heavy duty retraction spring.
   2. Pop-up body shall have integral check valve capable of preventing low-head drainage up to 10 feet of head.
   3. Pop-up height: 3 1/2 inches.
   4. Nozzle: as shown on Drawings.
   5. I-25 Series, Hunter Industries, San Marcos, CA, or accepted equal.

C. Flood bubbler: Plastic, pressure compensating, 0.5 GPM, Model No. 1402 Full Circle Bubbler, Rainbird Inc., or accepted equal.

2.6 DRIP SYSTEM EQUIPMENT

A. Provide all components required for complete system.
   1. Pressure regulator/filter: Brass, No. 500 YSBR Series strainer and pressure reducer; Wilkins, Paso Robles, CA or accepted equal.
2. Pressure gauge: 0-100 psi, Irrometer or accepted equal.
3. Multi-outlet emission devices: Shall have 4 or 8 individually controlled pressure compensating outlet ports. Provide distribution tubing, bug caps, stakes, staples and other equipment of same manufacturer as required for complete installation. Octa-Bubbler No. 816 and 856; PepCo Water Conservation Products, Inc., Fresno, CA or accepted equal.

2.7 PRESSURE REGULATOR
   A. Bronze body with integral stainless steel strainer, serviceable in-line.
   B. Rated to 300 psi; 180 degrees F.
   C. Wilkins 600 series or accepted equal, as shown on Drawings.
   D. Provide pressure gauge on each side of regulator.

2.8 BACKFLOW PREVENTION DEVICE
   A. Reduced pressure type, bronze with stainless steel springs, with 2 ball valves, pressure rated to 175 psi, ____ inch size. Model No. 825Y BV, Febco Industries, Fresno, CA or accepted equal.
   B. Enclosure: Galvanized steel mesh, size to accommodate BFP assembly, with hinged cover and padlock hasps. Le Meur Industries; as available from Ewing Irrigation, San Leandro, CA or accepted equal.
   C. Paint enclosure black with prime coat and 2 coats of acrylic exterior semi-gloss enamel, corrosion resistant. Clean, prime and paint enclosure per paint manufacturer’s specifications. Do not use for solid enclosures, only mesh.
   D. Insulated cover: Vinyl coated polyester fabric, green color, lockable; size to fit BFP assembly. "Weatherguard" blanket; available from Ewing Irrigation, or accepted equal.

2.9 CONTROLLER - Shall have the following features:
   A. Single manufacturer’s system, including controller, stainless steel top entry enclosure, junction box and prewired terminal strip. Provide malfunction warning light as accepted. Controller shall be compatible with radio/telephone control system, rain shutoff, moisture and flow sensors. UL listing; pedestal mount.
B. Solid state, microprocessor-based; capable of fully-automatic, semi-automatic or manual operation.

C. Programming: 36 stations. 12 programs; or individual station programming. Station timing: At user’s option. Non-volatile memory.

D. Review program; field wire fault detection.

E. Master valve/pump start circuit.

F. Water budgeting: 0 - 999 percent.

G. 8 starts per program per day.

H. Standby watering schedule.

I. Controller assembly shall have 5 year warranty.

J. Model No.___________; RainMaster Evolution DX series controller assembly, as shown on Drawings, or accepted equal; available from ETS, Pacheco, CA (510) 609-2180.

K. Telephone connection equipment:
   1. Schedule 80 conduit, nylon pull rope, conductor cable and connection to telephone company’s equipment.
   2. Equipment related to telephone connection shall be approved by telephone company.

2.10 FLOW SENSOR for rainmaster controllers

A. Schedule 80 PVC with removable, non-magnetic sensing mechanism. Rated to 100 psi at 140 degrees F.

B. Sensing mechanism: Electronic detector, glass reinforced polyphenylene sulfide housing with glass reinforced nylon impeller, UHMWPE bearing, tungsten carbide shaft, and EPDM O-rings.

C. Model No. EVFM P200 with EV-CAB-SEN cable, RainMaster; or accepted equal. Available from ETS, Pacheco, CA.

2.11 CONTROL WIRE

A. Control wire: Soft-annealed, uncoated copper, single conductor, with PVC insulating jacket, UL approved for direct burial, size and color as follows:
   1. Common ground: White, size #12 AWG-UF.
2. Control wire: Color other than white, size #14-1 AWG-UF.
   
   B. Provide separate common ground for each controller.
   
   C. Connections: Gel-sealed waterproof connector kit, UL listed for direct burial splices, with spring connector, vinyl insulator and moisture proof snap top packet. DBY/DBR connector sealing packs, 3M Company, Austin, TX, or accepted equal.

2.12 RAIN SENSOR

   A. Shall be hygroscopic disks housed in UV stabilized, thermoplastic housing with weatherproof switch mechanism and 6 inch aluminum mounting bracket, with automatic return to normal watering cycle.
   
   B. Click stop settings shall measure rainfall in quantities of 1/8 to 1 inch and shut off watering cycle during rain. Set device to shut off system when rainfall reaches 1/2 inch.
   
   C. Shall be low voltage, UL listed, with 25 feet of #20 AWG 2 conductor wire and lead wire for normally open wiring. Provide additional mounting hardware and wiring to suit Project conditions.
   
   D. Model No. 502, Mini-Clik II, Glen-Hilton Products, Inc., Richmond, VA, or accepted equal.

2.13 SPECIAL TOOLS

   A. Furnish the following tools:
      1. 2 sets of special tools and valve keys required for operating, removing, disassembling and adjusting each type of valve supplied on the Project. Include tools not normally found in possession of maintenance personnel.
      2. 2 quick coupler keys and matching hose swivels.

2.14 TRENCH BACKFILL

   A. Trench backfill in planting areas shall meet requirements of Section 32 90 00 - PLANTING.
   
   B. Trench backfill under paving shall meet requirements of Section 31 23 33.

2.15 OTHER MATERIALS

   A. Concrete: Per State of California Department of Transportation, Standard Specifications, 1992 Edition; Section 90-110 - “Minor Concrete.”
B. Drain rock: 3/4 inch washed drain rock.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Progress observations: In addition to the observations specified below, Owner’s Representative will make periodic progress observations.

B. Notify Owner’s Representative in advance of the following observation meetings, as indicated:
   1. Field layout: 3 days.
   2. Pressure supply line installation and testing: 48 hours.
   3. Controller installation: 48 hours.
   5. Maintenance period observations: 7 days.
   6. Final observation: 7 days.

C. Owner’s Representative will refuse review if Contractor calls for a site visit without specified record drawings, without completing previously noted corrections, or without preparing the system for review.

3.2 COORDINATION

A. Inspect, become familiar with, and protect existing site utilities and Project utilities.

B. Coordinate placement of items to be embedded into concrete work or installed under paving.

C. Design pressure is 96 psi static. Verify static pressure at P.O.C. before starting construction and notify Owner’s Representative if it varies by more than 10 psi in either direction.

D. Irrigation demand is 115 GPM. Verify at P.O.C. before starting construction.

3.3 LAYOUT

A. Before installation, stake layout of pressure supply lines and valves for review. Coordinate with staked layout of trees provided under Section 02900 - PLANTING. Adjust as directed.

B. Drawings are diagrammatic. Provide necessary fittings and offsets to adapt to existing conditions and prevent conflicts with other work and existing improvements.
C. Backfilling:
1. Backfill with specified material after testing pipe. Backfill shall be compacted to a density equal to adjacent soil, or as specified.
2. Correct subsequent settlement of trenches, and correct any damage caused by settlement.

D. Sleeves and conduit:
1. Provide sleeves and conduit of sufficient size and quantity to accommodate all pipe and wiring.
2. Install minimum 7 inches below bottom of pavement base, and at least as deep as required depth of pipe.
3. Backfill and test as specified in Section 31 23 33.
4. Sleeves and caps shall be Schedule 40 PVC unless otherwise shown, minimum twice the irrigation line diameter, and extend minimum 12 inches beyond edge of pavement. In-line fittings are not permitted in sleeves less than 20 feet long. Cap ends of sleeves hand tight until pipe is installed.
5. Install sleeves and conduit level and in straight line.
6. Backfill with 4 inches clean sand on all sides of sleeves, and compact by tamping.
7. Mark locations of sleeve ends with 2 x 4 stake extending 6 inches above finish grade, for future location during construction. Label stake clearly with letter "I". Remove stake when assembly is completed.

3.4 BACKFLOW PREVENTION DEVICE

A. Connect to water supply line in approximate location shown on Drawings. Final location will be accepted by Owner’s Representative.

B. Installation shall comply with applicable codes. Arrange and pay for tests and certificates required by governing agencies.

3.5 PIPE

A. General:
1. Pipe under existing paving shall be installed by jacking or boring.
2. Do not use pipe joint compound on sprinkler bases or remote control valves.
3. Cap open pipe ends as pipe line is assembled to keep out soil or debris. Remove caps only when necessary to continue assembly.
4. Sleeve pipe under paving. Where pipes or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeves to keep soil out.
5. Pipe wrapping: Wrap galvanized pipe and fittings in contact with soil and to 3 inches above soil line. Overlap tape 1/2 its width.
6. Provide check valve where required to prevent erosion from low head drainage.
B. Solvent-weld PVC:
1. Plastic pipe shall be installed to accommodate expansion and contraction as recommended by manufacturer.
2. Install PVC pipe in trench with manufacturer's markings facing up.
3. Cut pipe ends square and remove burrs. Pipe and fitting shall be free of dirt, dust and moisture.
4. Dry-insert pipe into fitting to check for missizing. Pipe should enter fitting 1/3 to 2/3 depth of socket.
5. Apply primer to socket and pipe end. Apply heavy coat of cement to pipe end. Apply light coat of cement to inside of socket and second coat to pipe end.
6. Insert pipe into fitting and turn 1/4 turn until pipe seats to the bottom of the socket. Check alignment of pipe and fitting.
7. Hold joint still for 30 seconds and remove excess cement.
8. Cure joint minimum 30 minutes before handling and 6 hours before filling with water.
9. Follow additional manufacturer's instructions.

C. Threaded joints:
1. Field threading of plastic pipe or fittings is not permitted. Use factory-made threads only.
2. Use factory-made metal nipples wherever possible. Field cut threads in metal pipe may be used only where approved by Owner’s Representative. Cut threads accurately on axis with sharp dies.
3. Apply pipe joint compound to male threads and first 3 female threads.
4. On metal to metal joints, no more than 3 full threads shall show when joint is complete.
5. When assembling threaded plastic fittings, tighten joint no more than 1 full turn beyond hand tight. Use strap type friction wrench only; do not use metal-jawed wrench.

3.6 VALVES
A. General:
1. After pipe and risers are in place and connected and before installation of valves, flush out system with a full head of water. Lines shall be free of soil or debris.
2. Locate and install as shown. Location of valves and alignment of boxes shall be approved by Owner’s Representative.

B. Valve box installation, general:
1. Install boxes 18 inches from walk or header and 12 inches apart. Short side of rectangular boxes shall be parallel to walk or header. Install boxes 2 inches above finish grade in groundcover areas; flush in lawn areas.
2. Install common bricks as shown and as required to keep box stable. Place pea gravel inside box for drainage as shown.
3. No soil or accumulated water is permitted in valve boxes. Install PVC tape over box side cutouts.
4. Show locations of boxes on record drawings.

C. Remote control valve:
   1. Install where shown on Drawings; group boxes together and install in groundcover areas wherever possible.
   2. Install a separate box for each valve.
   3. Each remote control valve shall have a separate riser and connection to mainline. Do not manifold valves to a single riser from mainline unless shown on Drawings.
   4. Number valves in sequence shown on Drawings.
   5. Label each valve with controller and station number on 2 1/4 inch x 2 3/4 inch polyurethane tag attached to control wire.

D. Quick coupling valve: Set valve perpendicular to finish grade unless otherwise shown.

3.7 SPRINKLERS

A. Thoroughly flush lines before installing sprinkler heads.

B. Locate and install heads, risers and fittings as shown. Notify Owner’s Representative where field conditions or obstructions prevent adequate coverage.

C. Set heads perpendicular to finish grade unless otherwise shown.

D. Install tree bubblers in perforated polystyrene drain pipe filled with drain rock, flush with grade, as shown on Drawings. Provide removable cap.

E. Adjust sprinkler heads for proper distribution and trim, providing complete coverage with minimal overspray.

3.8 EMITTERS

A. Install emitter irrigation as shown; minimum 1 emitter per shrub, 4 per tree, 1 per vine. Add emitters if required to supply adequate water to plants.

B. Place emitters on top of rootballs. On slopes, place at least 1 emitter on uphill side of rootball.

C. Bury distribution tubing from emitter box to plant. Do not dig into plant rootball; fasten emitters to rootballs with 4 inch galvanized staples as approved.
D. Follow manufacturer's installation instructions.

E. Do not exceed 15 feet of distribution tubing from emitter box.

3.9 CONTROLLER

A. Install in approximate location shown on Drawings. Exact location will be accepted by Owner’s Representative. Connect to disconnect switch.

B. Controllers shall be factory mounted in manufacturer's enclosure unless otherwise shown. Mount enclosure as shown.

C. Connect control wires to controller according to valve numbers shown, in sequence shown on Drawings. Label each control wire with permanent label showing station number of valve controlled.

D. Rain sensor: Mount in location accepted by Owner’s Representative, as shown on approved shop drawings. Connect according to manufacturer's instructions and wiring diagrams.

E. Control wire:
   1. Run lines along mains wherever possible. Provide separate conduit for wires under paving. Tie wires in bundles with 1-inch wide electrical tape at 10-foot intervals and allow slack for contraction between strapping. Tape is not required in sleeves.
   2. Loop 3 feet of extra control and ground wires in 1 inch diameter coil, at each valve, at 100 foot intervals along wire runs, and at changes of direction.
   3. Splicing is not permitted.
   4. Install spare control wire of different color for each controller along entire main line.

F. Programming: Programming is the responsibility of Contractor throughout construction and maintenance period. Provide optimum amounts of water for each plant type to maintain plants in vigorous healthy condition. Reprogram as required at end of maintenance period.

3.10 TESTING PIPE

A. Pipe shall be center-loaded with approved backfill to anchor pipe before testing. Do not cover fittings.

B. Before testing, bleed air out of lines at line pressure. Provide vertical pipe at high points during installation.
C. Do not cover or enclose work until tests are approved by Owner’s Representative.

D. Solvent weld pipe: Test hydrostatically after joints have cured at least 24 hours. Provide caps, pumps, pressure gauges and other equipment required to perform test.
   1. Test pressure mainline at 150 psi for 2 hours and prove watertight.
   2. Cap sprinkler risers and test lateral lines at line pressure. Review system for leaks.

E. Repair leaks and repeat tests until system is proven watertight.

F. Remake faulty joints with new materials. Do not use cement or caulking to seal leaks. Repairs shall conform to Specifications.

3.11 DRIP SYSTEM POST-INSTALLATION CHECK

A. Immediately after installation, flush lateral line piping by removing the last emitter from each line.

B. Clean filter screens. Open filter flush valve for at least 10 seconds. Clean or replace clogged elements.

C. Operation check: While system is operating, check pressure gauge downstream from filter. Pressure shall be minimum 80 percent of supply pressure and minimum 10 percent above the setting of the pressure regulator.
   1. Clean or replace filter element as required to obtain specified pressure.

D. Adjust pressure regulator to system design pressure.

E. Verify that emitters are producing specified water output. If not, replace emitters, check filter element, check pressure at emitters, and review system for clogs and leaks. Correct deficiencies.

3.12 SYSTEM ADJUSTMENT

A. Flush and adjust sprinkler heads for optimum performance. Prevent overspray onto walks, roadways, paving and buildings. Adjust nozzle sizes and degree of arc, and install pressure compensating screens, as required to cover planting areas without overspray. Adjust valve flow controls.

B. Test and adjust entire system at completion of each phase or section of work.

C. Perform coverage test in the presence of Owner’s Representative to establish that coverage of all planting areas is complete and adequate. Correct deficiencies and repeat test until approved.
3.13 OPERATION INSTRUCTION

A. Provide 6 hours instruction in operation and maintenance of system to Owner's maintenance personnel, at time accepted by Owner. Provide instruction by manufacturer's representative where Contractor is not expert in operation of equipment.

3.14 MAINTENANCE

A. Maintain irrigation system in working order from beginning of work until Final Acceptance. Maintenance of system includes, but is not limited to: Flushing system and adjusting heads; providing optimum amounts of water to plants; replacing lost, stolen or damaged equipment; reprogramming controller.

1. Handwater as required for plant establishment.

B. Request observation for commencement of maintenance period after work of this Section and Section 32 90 00 is complete. Maintenance period shall begin upon written notice of acceptance by Owner’s Representative and continue for minimum 90 days or until Final Acceptance.

C. Operate system during observation as directed by Owner’s Representative.

3.15 FINAL ACCEPTANCE

A. Final acceptance of irrigation system will be made after all work is complete and upon final acceptance of planting work as specified in Section 32 90 00.

END OF SECTION
SECTION 32 90 00

PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes providing planting complete, including but not limited to:
   1. Finish grading of landscaped areas.
   2. Imported topsoil and soil amendments.
   3. Planting.
   4. Tree stakes.
   5. Wood bark mulch.
   6. Organic mulch.
   7. Maintenance through Final Acceptance.
   8. Warranty replacement.

B. Related sections:
   1. Section 32 84 00 - Irrigation.

1.2 DEFINITIONS

A. Finish grade: Top of soil surface after settling.

1.3 SUBMITTALS

A. Procedures: In accordance with Section 01 33 00.

B. Materials data: Submit complete materials list of plants, soils, amendments, fertilizers and non-proprietary items to be provided under this Section, including source, size, and quantity.

C. Product data: Submit manufacturer's specifications, installation instructions and catalog cuts for all materials different from those specified. Requests for substitutions shall comply with Section 01 33 00.

D. Samples:
   1. Wood bark mulch: 1/2 cubic foot of each type.

E. Test reports: Submit results of the following tests, recommendations and analysis. Test reports shall be test number specified, as provided by Waypoint Analytical, Inc, or accepted equal.
   1. Provide Project Specifications for import topsoil, import soil, soil amendments and fertilizer to Testing Laboratory.
   2. Existing site soil: Provide Test A05, for agricultural suitability, fertility, particle size analysis; including recommendations for soil amendment and backfilling, and fertilization during Maintenance Period. Number of samples to be as recommended by Testing Laboratory, minimum 4 samples.
a. Certify that soil is free of herbicides or other harmful substances. Perform monocot and dicot growth trials, Test M05. Number of samples as recommended by Testing Laboratory, minimum 4 trials.

3. Import topsoil (if required): Provide samples of import topsoil to Testing Laboratory. Include manufacturer's analysis of proposed amendment, dated within 6 months before delivery, or sample of organic amendment for Testing Laboratory's analysis if manufacturer's analysis is not available.

4. Testing Laboratory shall certify that proposed import topsoil complies with Specifications and that it is compatible with site soil.

5. Testing Laboratory shall propose changes in amendment program specified, if required, and shall certify that amendments proposed are suitable for use with site soil and import topsoil.

6. Import soil: Submit test reports of representative sample prior to delivery and for every 100 yards delivered to the site. Test A05, for agricultural suitability, fertility, particle size analysis; including recommendations for soil amendments, and fertilization during Maintenance Period.

7. Planter pot soil mix: Submit test results showing compliance with Specifications.

8. Hydroseeding mulch: Submit manufacturer's test results, taken within 6 months before delivery, showing compliance with Specifications.

9. All other fertilizers and amendments: For standard products, submit manufacturer's analysis. For all other products, submit analysis by Testing laboratory.

10. Submit test results, analysis and recommendations for site soil, import soil, fertilizer and organic amendment together, as a package.

11. Palm Certification: Written certification by a qualified palm inspector, approved by the Owners Representative, that the palm trees are free of fusarium or other lethal diseases. Testing shall take place no earlier than 60 days prior to arrival of palms on site. No Palms shall be delivered to the site without certification that the palm is disease free.

F. Herbicides: Submit manufacturer's analysis. Schedule for application of herbicides shall be accepted by Owner’s Representative.

G. Record drawings: Prepare record plans indicating plant type, quantity, size and location. Submit to Owner’s Representative within 10 working days of start of Maintenance period.

1.4 QUALITY ASSURANCE


1. Form numbers specified refer to tests of Waypoint Analytical, Inc. Equal tests of approved laboratory may be substituted.

2. Format of test reports, analysis and recommendations shall meet approval of Owner’s Representative. Resubmit until accepted.

B. Reference standards: Comply with applicable provisions of the following:


1.5 DELIVERY, STORAGE AND HANDLING

A. Fertilizers, amendments and other materials: Store protected from damage. Protect site surfaces.

B. Plants: Maintain plant material in healthy growing condition at all times. Protect plants from sun and drying winds. Plants that cannot be planted immediately upon delivery shall be kept in the shade, watered and protected. Owner’s Representative reserves the right to reject plants which decline in quality after delivery to site.

1.6 SUBSTITUTIONS

A. Owner’s Representative reserves the right to substitute plant material of the same size as material specified, until plant material is delivered, at no additional cost to Owner.

1.7 WARRANTY

A. Provide 18 month guarantee for Work of this Section in accordance with provisions of Section 01 00 00.

B. Provide supplemental guarantee, on Contractor's letterhead:
   1. Plant material: Warrant that all plant material under this Contract will be vigorous, healthy, free of dead or dying branches and branch tips, bearing foliage of normal density and color, and will otherwise comply with these Specifications for a period of 18 months from date of Substantial Completion.
   2. Replacements: Without cost to Owner, in a timely manner and as directed by the Owner’s Representative, replace all plants not meeting the requirements above during and at the end of the Warranty Period. Replace plants which are identified, within 3 years, as not being true to name as specified, with the specified plant. Replacements shall closely match adjacent specimens of the same species in size at the time of replacement, and shall comply with all requirements of this Specification.

PART 2 - PRODUCTS

2.1 GENERAL

A. Specifications for soils, fertilizers and amendments are provided as a guide for bidding purposes. If a change in the amendment program or plant material is recommended by the Testing Laboratory as determined by the soil test results, it shall be implemented at no additional cost to the OWNER.

2.2 PLANTS
A. General: Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least one year unless otherwise accepted by Owner’s Representative.

B. Quality: Plants shall be compact and symmetrical; sound, healthy and vigorous, well branched and densely foliated when in leaf; free of disease, insect pests, eggs or larvae, and free from physical damage or adverse conditions that would prevent thriving growth.

C. Plants shall be labeled at the supplying nursery with genus, species and variety.

D. Rootball:
   1. Do not supply bare root or ball and burlap stock, except for palms, unless accepted by the Owner’s Representative.
   2. Sizes: As shown on Drawings.
   3. Root systems shall be healthy and free from twisting or girdling.
   4. Containers: All plant material shall have been grown in the containers in which delivered for at least six months, but not over two years.

E. Pruning: Do not prune plants before delivery.

2.3 SOIL

A. General: Soil in all planting areas shall be free of rocks over one inch in diameter, sub-soil, refuse, plants or roots, clods, weeds, viable weed seeds, sticks, solvents, petroleum products, concrete, base rock, or other harmful substances.

B. Imported topsoil: Form 430-A as determined by Testing Laboratory.
   1. Physical properties: USDA sandy loam.
      
      | Particle Size Range | Percent |
      |---------------------|---------|
      | Coarse sand .5 - 2.0 mm | 0-15% |
      | Silt plus clay <0.05 mm | 15-50% |
      | Gravel 2-13 mm | 0-20% |
      | Rock 1/2 - 1 inch | 0-10% by volume |
      | Organic matter | 0-15% |

   2. Chemistry:
      Salinity: less than 3.0 mmhos
      Sodium adsorption: less than 6.0
      Boron: Less than 1.0 ppm
      pH of saturated paste: 5.5 - 7.5
   3. Qualitative lime level shall be low in opinion of Testing Laboratory.
   4. Fertility characteristics shall be modifiable by the incorporation of conventional fertilizers to provide fertility levels to sustain normal growth.

C. Sand: Uniform fine sand, Form 416 A as determined by Testing Laboratory.
   1. Sieve analysis, percent passing by weight:
      No. 4 100
      No. 10 95-100
2. Chemistry:
   b. Boron (saturation extract concentration): Nil - 1.0 ppm.
   c. Sodium (SAR): Nil - 6.0.

2.4 SOIL AMENDMENTS

A. Wood residual soil amendment: Nitrogen and iron stabilized redwood, fir or cedar sawdust, 0 x 1/4 inch. Form 404-A-SC.
   1. Particle size (dry weight basis):
      Sieve size       Percent passing
      9.51 mm (3/8 inch)   100
      6.35 mm (1/4 inch)   95-100
      4.76 mm (No. 4)     80-100
      2.38 mm (No. 8, 8 mesh)  50-80
      1.00 mm (No. 18)    20-70
      500 micron (No. 35, 32 mesh)   0-30
   2. Nitrogen: Minimum 0.4% nitrogen based on dry weight.
   3. Salinity: Maximum saturation extract conductivity 4.0 millimhos per cm at 25 degrees centigrade.
   4. Iron: Minimum 0.08% dilute acid soluble Fe based on dry weight.
   5. Organic matter: 220 pounds per cubic yard.

B. Fir bark for soil mixes: Raw, untreated ground fir bark, 0 x 1/8 inch size. Form 416 A specs.
   1. Particle size (dry weight basis):
      Sieve size       Percent passing
      9.51 mm (3/8 inch)   100
      6.35 mm (1/4 inch)   95-100
      4.76 mm (No. 4)     90-100
      2.38 mm (No. 8, 8 mesh)  75-100
      1.00 mm (No. 18)    45-70
      500 micron (No. 35, 32 mesh)   0-30
   2. Salinity: Maximum saturation extract conductivity 4.0 millimhos per cm at 25 degrees centigrade.
   3. Organic matter: Minimum 350 pounds per cubic yard.
   4. pH: Minimum 4.0

C. Yard waste compost: (to be added)

2.5 FERTILIZER

A. Fertilizer tablets: 7 gram tablets in the nutrient formulation 12-8-8; Gro-Power Planting Tablets, Gro-Power, Inc., Chino, CA., or accepted equal.
B. Commercial grade fertilizer:
   1. Complete fertilizer: Homogenous pellet, containing major nutrients specified plus iron, sulfur and zinc. Best's Fertilizer, J.R. Simplot Co., Lathrop, CA or accepted equal.
   2. Complete fertilizer: Beaded homogenous granulated organic fertilizer, 100 percent passing #4 mesh screen. Nutrient formulation 5-3-1, minimum 75 percent of nitrogen derived from slow-release urea, plus iron, manganese and zinc. Shall contain 15 percent humic acid, shall not be derived from sewage sludge, and shall be free of harmful substances.

C. Potassium sulfate: 0-0-52; manufactured for horticultural use.

D. Iron sulfate: Ferric sulfate, containing minimum 20% iron expressed as elemental. Caution: Iron sulfate will stain concrete, granite, stucco and tile surfaces. Avoid contact between site surfaces and soil containing iron sulfate. After iron sulfate application, broom or air blow surfaces free of material before any water application, including impending rains.

E. Soil sulfur: manufactured for horticultural use.

F. Agricultural gypsum: manufactured for horticultural use.

2.6 OTHER MATERIALS

A. General: All materials supplied shall be free of harmful substances.

B. Wood bark mulch:
   1. Slopes less than 3 to 1: "Small Fir Bark" Mulch, 1/4 inch to 3/4 inch diameter, as available from Sun Up Forest Products, Sacramento, CA or accepted equal.
   2. Slopes 3 to 1 or steeper: Shredded fir, cedar or redwood bark. "Walk-on" bark mulch; American Soil Products, San Rafael, CA, or accepted equal. "Gorilla hair" mulch is not acceptable.

C. Organic mulch:
   1. "Forest Floor Bark" Mulch, Composed of fir bark from course to sawdust size pieces resembling a forest floor, as available from American Soil Products, Inc, San Rafael, CA or accepted equal.

D. Staking and guying materials:
   1. Wooden stakes: Lodge pole pine, 10-foot length, 3-inch diameter, with 10-inch tapered driving point and chamfered top; treated with wood preservative to heartwood; green color; as available from C and E Lumber Co., Pomona, CA; California Cascade, San Jose, CA; or accepted equal.
   2. Ties: Black plastic "Standard Tree Ties," Worldwide Tree Ties, Cupertino, CA; Black rubber "Gro-Strait", Gro-Strait, Walnut Creek, CA; or accepted equal. Provide ties without wires. Length of tie as required to adequately support tree while secured directly to stakes.
3. Guying anchors: "Duckbill" guying kit, with white vinyl coated aircraft cable. Size as recommended by manufacturer, except that minimum size kit shall be 68 DTS; 1 kit per tree. Foresight Products, Inc., Commerce City, CO, or accepted equal.
   a. Provide 30 inch long, 1/2 inch diameter PVC pipe warning flag at each guy.
   b. Eyebolt (if required as substitute for guy anchor): 1 inch diameter eye x 3/8 inch diameter x 4 1/2 inch long, galvanized, with cable clamp and turnbuckle as required.

4. Rootball stabilization at tree grates: "Duckbill Rootball Fixing Kit", size as recommended by manufacturer, except that minimum size kit shall be 68 DTS; 1 kit per tree. Foresight Products, Inc., or accepted equal.

5. Vine attachment:
   a. Wire: Green, vinyl clad, galvanized, 14 gauge.
   b. Screweyes: Galvanized, 1/8 inch x 1/2 inch diameter eye, 2 1/2 inches long.

E. Water: Potable.

F. Herbicide: California State licensed Pest Control Operator shall identify weeds and propose product, method and rate of application for review. Provide manufacturer's literature.

G. Anti-desiccant: Furnish evidence that material can be used safely on plant materials specified.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Progress observations: In addition to the installation observations specified below, periodic progress observations may be made by the Owner’s Representative.

B. Installation observations: Request at least 3 days in advance:
   1. Observation of finish grading.
   2. Observation of plant material upon delivery to site.
   3. Observation of layout and placement of plant material at time of planting.

C. Maintenance Observations: For the purpose of establishing the start of Maintenance Period and observing completion of the Work of this Section through Final Acceptance. Request at least 7 days in advance:
   1. Observation for Maintenance Period commencement.
   2. Observation for Final Acceptance.

3.2 ORDERING, REVIEW AND ACCEPTANCE OF PLANT MATERIAL

A. Ordering: 90 days before start of planting work, submit written certification to Owner’s Representative of the quantity, species and source of plant material ordered.

B. Owner’s Representative reserves the right to review plant material before shipment.

C. Owner’s Representative will review plant material at project site upon delivery. Arrange material so that canopies or branch tips are not touching.
D. Do not install material which has not been reviewed and accepted by Owner’s Representative.

E. Arrange and pay for permits and inspections required for delivery of plant material.

3.3 SITE PREPARATION

A. Herbicides (if accepted):
   1. Apply site preparation herbicide in accordance with manufacturer's instructions to all areas with weed cover, both site soil and import soil.
   2. After 10 days, mow weeds and remove clippings from site.

B. Review planting areas for presence of rock, chemicals or other harmful substances. Obtain Owner’s Representative's instructions before proceeding with work.

C. Owner’s Representative may require removal of site soil and replacement with import topsoil if site soil is not accepted for use.

D. Thoroughly scarify all planting areas by cross-ripping or other approved means to a depth of 8 inches. Do not scarify within dripline of existing trees.

E. Confirm that irrigation system is fully operational including controller prior to installation of any plant material.

3.4 IMPORT TOPSOIL

A. Provide import topsoil where shown, where site topsoil is not accepted for use, or where additional soil is required to achieve finish grades shown.

B. After scarification of subsoil, place 3 inch layer of approved import soil and thoroughly rototill into the top 3 inches of subsoil.

C. Place remaining soil to depth required, in maximum 8 inch lifts.

D. Thoroughly settle each lift of soil by watering, rolling or other means as determined by Contractor.

3.5 SOIL AMENDMENTS

A. Rototill planting areas to 6 inch depth before spreading amendments. Loosen soil and incorporate amendments by hand within dripline of existing trees.

B. Spread evenly and thoroughly rototill to 6 inch depth the following amendments per 1,000 square feet:

   - 4 cubic yards Wood residual soil amendment as specified
   - 200 pounds 5-3-1 granulated organic fertilizer (Gro-Power)
   - 5 pounds Potassium sulfate
   - 10 pounds Soil sulfur

3.6 FINISH GRADING
A. Provide positive surface drainage of all planted areas.

B. Notify Owner’s Representative of obstructions, discrepancies or other conditions which prevent providing positive surface drainage before proceeding with work.

C. After amendment and settlement of soil, grade planting areas to required finish grades.

D. Surfaces shall be smooth and free of depressions or abrupt transitions.

E. Owner’s Representative reserves the right to make minor adjustments in finish grades as work progresses.

F. Finish grades after settling shall be 1 1/2 inches below adjacent walls and walks in groundcover areas, and 1 inch below adjacent walls and walks in lawn areas, unless otherwise shown.

G. Owner’s Representative will review finish grades before planting begins.

3.7 HANDLING OF PLANTS

A. General: Prevent damage to plant material. Lift and handle plants only from bottom of rootball.

B. Access: Inspect Project site and become familiar with the accessing requirements and restrictions. At time of submitting bid, provide written notice of any conditions which would prevent installation of the specified plant material.

C. Anti-Desiccant: At Contractor's option.

3.8 LAYOUT

A. General: Owner’s Representative will review, for conformance to design intent, locations of all plants in the field prior to planting. Notify Owner’s Representative and schedule layout review sufficiently in advance of planting to allow for review and adjustment without disrupting construction schedule.

B. Trees: Stake layout of trees in field before installing irrigation. Adjust as directed by Owner’s Representative.

C. Adjustments: Owner’s Representative reserves the right to make minor adjustments in the layout of all plant material; adjust irrigation system as necessary.

3.9 EXCAVATION OF PLANT PITS

A. Scarify sides and bottom of pit to eliminate glazed surfaces.

B. Excavate plant pits to 2 times rootball width. (Remove site soil from site.) Backfill bottom of pit with unamended site soil (import topsoil), if required, so that crown of plant will be at specified height at end of maintenance period. Soil under rootball shall be very firmly compacted to prevent settlement.
C. Obstructions: If rocks, underground construction work, tree roots or other unknown obstructions are encountered in the excavation of plant holes, alternate locations may be selected by Owner’s Representative. Report all such conditions in writing to the Owner’s Representative. Where locations cannot be changed, submit a written proposal and cost estimate for removing the obstructions to a depth of not less than 6 inches below the required hole depth. Obtain Owner’s Representative's instructions prior to proceeding with the work affected.

3.10 DETRIMENTAL SOILS AND DRAINAGE

A. Prior to planting, test drain all planting areas as follows:
   1. Plant pits: Fill with 12 inches of water. Water shall drain completely in 48 hours.
   2. Plant beds: Irrigate until soil is saturated. Saturated condition shall not remain after 24 hours.

B. Failure of drainage test: Report in writing to Owner’s Representative all areas not passing these tests, and all soil conditions that Contractor considers detrimental to growth of plant material. State condition, and proposal and cost estimate for correcting the condition. Obtain Owner’s Representative's instructions prior to proceeding with work affected. Repeat drainage testing and correction of conditions until tests are passed. Failure to perform drainage tests, or to notify Owner’s Representative in writing of conditions specified above, renders Contractor responsible for all plant failure that occurs as a result of inadequate drainage or detrimental soil conditions, as determined by Owner’s Representative.

3.11 PLANTING

A. General: Do not plant material that has not been reviewed by Owner’s Representative upon delivery to the project site, or that has been rejected for any reason. Do not plant under unfavorable weather conditions.

B. Rootballs:
   1. Do not install plants with damaged rootballs.
   2. Shrubs and groundcovers: If rootbound, score with sharp knife, making 4 cuts, and gently spread lower 1/3 of rootball.
   3. Trees: If rootbound, gently roughen sides of rootball to depth of 1 to 2 inches to loosen and spread encircling roots. Cut roots which are too stiff to untangle.

C. Backfilling:
   1. In top 12 inches of plant pits, use backfill mix as follows, thoroughly blended.
      2/3 cubic yard pulverized site soil (import topsoil)  
      1/3 cubic yard nitrogen and iron fortified organic amendment  
      1 1/2 pounds 6-20-20 pelletized fertilizer  
      1 1/2 pounds potassium sulfate (0-0-52)  
      1 1/2 pounds iron sulfate  
      a. Below 12 inch depth, omit organic amendment.

Gro-power
   1. In top 12 inches of plant pits, use backfill mix as follows, thoroughly blended.
      1/3 cubic yard nitrogen and iron fortified organic amendment  
      2/3 cubic yard pulverized topsoil
15 pounds 5-3-1 granulated organic fertilizer (Gro-Power)

2. Owner’s Representative may require substitution of import topsoil for site soil where site topsoil is not accepted for use, and changes in backfill mix as recommended by Testing Agency.

3. (Site soil shall not be used for backfill.)

D. Fertilizer Tablets: Place fertilizer tablets evenly distributed in plant pit when backfilled 2/3, according to the following schedule:

- 1 gallon: 1 21-gram tablet
- 5 gallon: 3 21 gram tablets
- 15 gallon: 5 21 gram tablets
- 24 inch box: 8 21 gram tablets
- 36 inch box: 12 21 gram tablets
- flats: 1 7-gram tablet
- 1 gallon: 3 7-gram tablet
- 5 gallon: 9 7 gram tablets
- 15 gallon: 15 7 gram tablets
- 24 inch box: 16 7 gram tablets
- 36 inch box: 20 7 gram tablets

E. Settlement: Reset plants which shift or settle before end of maintenance period. Crowns of trees shall be at the following minimum height above surrounding finish grade at end of maintenance period:

- 24 inch box and smaller: 2 inches
- 36 inch box and larger: Minimum 2 inches, or as directed by Owner’s Representative

F. Mulching: Mulch all planting areas with 3 inch deep layer of wood bark mulch, except for 1 1/2 inch deep layer in groundcover areas planted from flats. Do not pile mulch around crowns of plants.

G. Mulching - organic: Mulch areas shown on plans with 3 inch deep layer of organic mulch.

H. Form a watering basin for each plant.

I. Thoroughly water all plants immediately after planting, eliminating air pockets. Prevent erosion.

J. Root barriers: Install as shown and as recommended by manufacturer on all trees within 5 feet of paving, curb, or wall, and continuous at perimeter of street tree wells.

3.12 STAKING AND GUYING

A. General: Stake or guy trees immediately after planting. Make modifications to staking procedures as required to accommodate field conditions, at no additional cost to Owner.

1. Allow 1 to 3 inches sway in trunk or branches; do not pull tight.

B. Staking: Stake trees with two stakes as shown on Drawings. Fasten with rubber ties secured directly to the stakes with lath staples; or fasten with plastic ties in accordance with manufacturer's instructions. Do not use wire to secure ties to stakes.
C. Guying: Space 3 guys evenly around rootball. Install guy kits and rootball stabilization kits as shown and as recommended by manufacturer.
   1. Where eyebolt is required as substitute for guy anchor, drill and epoxy into concrete where directed by Owner’s Representative.

3.13 PRUNING

A. Prune only as directed; according to reference standards.

B. Prune trees which overhang paving to maintain minimum clearance of 80 inches between lower branches and pedestrian traffic way.

3.14 GROUNDCOVER PLANTING

A. Finish grading: Place and amend soil and do all work to provide finish grades shown.

B. Mulching - bark: Install 3 inch layer wood bark mulch except for 1 ½ inch deep layer in groundcover areas planted from flats.

C. Mulching - organic: Mulch areas shown on plans with 3 inch deep layer of organic mulch.

D. Planting: Plant groundcover plants through wood bark mulch and erosion control fabric at the specified triangular spacing.

3.16 MAINTENANCE

A. General: Maintain all plants and planting areas from time of delivery, through installation and Maintenance Period, until Final Acceptance.

B. Schedule: Submit proposed maintenance work schedule to Owner’s Representative in writing for review at least 30 days prior to commencement of maintenance work. Maintenance work shall be done at times accepted by Owner.

C. Maintenance Procedures:
   1. General: Maintenance of new planting includes but is not limited to: Watering, cultivating, fertilizing, weeding, mulching; restaking, resetting plants to proper grades or upright positions; restoring watering basins; removal of dead flowers and broken twigs; pest, disease and weed control; erosion control; restoring finish grades with accepted and tested imported topsoil; taking precautions as necessary to prevent sunscald damage, flushing drainage system. Remove nursery tags and repair mulch 10 days before Final Observation.
   2. Protection: Protect planting areas and plants against damage until Final Acceptance. Maintenance also includes temporary fences, barriers, and signs as required for protection. Treat or replace damaged plants as directed by Owner’s Representative at no additional cost to Owner.
   3. Fertilization: Apply potassium sulfate and 16-6-8 fertilizer at the rate of 6 pounds each per 1000 square feet, 30 days after installation.
   4. Weed control:
      a. Keep site free of weeds during maintenance period.
      b. Identify weeds and apply accepted control methods.
c. Herbicides, if used, shall be applied by licensed Pest Control Operator according to manufacturer's recommendations.

D. Observation for Maintenance Period Commencement: Request after Work of this Section and Section 32 84 00 is substantially complete. Maintenance Period shall begin upon written notice of acceptance by Owner’s Representative and shall continue for a minimum of 90 days until Final Acceptance.

3.17 FINAL ACCEPTANCE

A. General: Work of this Section will be accepted when all work has been completed, including maintenance period but not including replacement of plants under guarantee. Before requesting observation for Final Acceptance, submit the following:
   1. Record planting plan.
   2. Supplier invoices and delivery slips for all materials installed.
   4. Notify Owner’s Representative before Final Acceptance observation of conditions which impede plant establishment and growth.

B. Deficiencies noted during maintenance period observation which have not been corrected will terminate the Final Acceptance observation and extend the maintenance period by 30 days. Costs associated with additional observations required as a result of Contractor's failure to correct deficiencies shall be borne by Contractor.

END OF SECTION
SECTION 33 05 16
UTILITY STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Manhole structures for gravity storm drain and sanitary sewer utilities.

1.2 RELATED SECTIONS
A. Section 31 23 33 – Trenching and Backfilling.
B. Section 33 40 00 – Storm Drainage Utilities.
C. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

1.3 RELATED DOCUMENTS
A. AASHTO:
   1. M 199: Precast Reinforced Concrete Manhole Sections.
B. ASTM:
   1. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
   2. C 478: Precast Reinforced Concrete Manhole Sections.
   3. C 1244: Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test.
C. Caltrans Standard Specifications.
   1. Section 51, Concrete Structures.
   2. Section 75, Miscellaneous Metal.
D. California Building Code.
   1. Section 1172B – Exterior Routes of Travel.

1.4 DEFINITIONS
A. AASHTO: American Association of State Highway and Transportation Officials.

1.5 SUBMITTALS
A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
B. Product data for the following:
   1. Cleanout plugs or caps.

C. Shop drawings: Include plans, elevations, details and attachments for the following:
   1. Precast concrete manholes, frames and covers.
   2. Precast concrete clean out boxes and box covers.

D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.
E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Handle precast concrete manholes according to manufacturer’s written instructions.

B. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Piping: Same as sanitary sewer line if possible.

B. Top Cap: Threaded and of same material as piping if possible.

C. Box Size: As required to provide access and allow easy removal and reinstallation of cap.

D. Box Types:
   1. Landscape Areas: Portland cement concrete box and box cover (bolt-down), light duty.
   2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover (bolt down) to be rated for AASHTO H20 loading.

E. Box Cover Markings: “S.D.” for storm drain cleanouts, “S.S.” for sanitary sewer cleanouts, unless otherwise specified.

F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
   1. Associated Concrete Products, Inc. (Santa Ana, California) (Tel. 714-557-7470).
   2. Brooks Products Inc. (El Monte, California) (Tel. 818-443-3017).
   3. Christy Concrete Products, Inc. (Fremont, California) (Tel. 800-486 7070).

2.2 MANHOLES

A. General: Size, shape, configuration, depth, etc. of manhole and frame and cover shall be
as indicated.

B. Portland Cement Concrete and Reinforcing:
   1. Cast-In-Place Portion: Use Class A Concrete per Caltrans Standard Specification Section 90, and ASTM A615 Grade 60 reinforcing steel bars.
   2. Precast Portion: ASTM C 478. Rate for AASHTO H20 loading in traffic areas.

C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-1.02.

D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091) or equal.

E. Force Main Piping Access Openings:
   1. General: As indicated.

2.3 JOINT SEALANT FOR STRUCTURES AND MANHOLES

   1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

B. Gaskets: Preformed flexible rubber or plastic gasket.
   2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek,” as manufactured by the K. T. Snyder Company (Houston TX), or equal.

PART 3 - EXECUTION

3.1 CLEANOUT INSTALLATION

A. General: Install as indicated.

3.2 MANHOLE INSTALLATION

A. General: Install as indicated.

3.3 TESTING OF MANHOLES ON GRAVITY LINES

A. At the option of the Contractor, either the following hydrostatic or vacuum test shall be performed.
B. Hydrostatic Test:
1. Insert inflatable plugs in all sewer inlets and outlets.
2. Fill the manhole with water to a point six inches below the base of the manhole frame.
3. Maintain the water at this point for one hour to allow time for absorption.
4. Begin one-hour test period. Measure the amount of water added in one-hour period to maintain the water level at six inches below the base of the manhole frame. Do not allow water level to drop more than 25% of the manhole depth.
5. Determine the allowable leakage by the following formula.
6. \[ L = 0.0002 \times D \times H \times \frac{1}{2} \]
7. \( L \) = Allowable leakage, gallons per minute.
8. \( D \) = Depth of manhole from top to bottom, feet.
9. \( H \) = Head of water in feet as measured from the surface of the water in the manhole to the sewer line invert or to the prevailing ground water surface outside the manhole. The lesser height governs.
10. If the leakage exceeds the allowable, determine the cause, take remedial action and re-test the manhole. If the leakage is less than the allowable and leaks are observed, repair the leaks.

C. Vacuum Test:
1. General: Test in accordance with ASTM C 1244.
2. Test prior to backfilling around the manhole.
3. Test Preparation: Plug all lift holes and pipes entering or exiting the manhole.
4. Place test head inside the top section of the manhole’s cone section and inflate in accordance with the manufacturers instructions.
5. Draw a vacuum of 10-inches of mercury and shut the pump off.
6. With the valve closed, the time for the vacuum to drop 9-inches shall be measured.
7. The manhole shall pass the test if the time is greater than 60 seconds for a 48-inch diameter manhole, 75 seconds for a 60-inch diameter manhole and 90 seconds for a 72-inch diameter manhole.
8. If the manhole fails the initial test, make necessary repairs with a non-shrink grout while the vacuum is still being drawn. Retest until a satisfactory test is obtained.

END OF SECTION
SECTION 33 10 00
WATER UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site water distribution system for domestic and fire protection services up to 5 feet of any on-site building being served.

B. Domestic water and fire protection water transmission or distribution system within a roadway or street right-of-way.

1.2 RELATED SECTIONS

A. Section 31 23 33 – Trenching and Backfilling.

B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

1.3 RELATED DOCUMENTS

A. ASTM:
   2. B 88: Specifications for Seamless Copper Water Tube.
   3. D 1785: Specifications for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

B. AWWA:
   3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water.
   9. C200: Steel Water Pipe-6 In. (150 mm) and larger.
   12. C207: Steel Pipe Flanges for Waterworks Service-Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
19. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe.
24. C507: Ball Valves 6 In. Through 8 In. (150 mm Through 1,200 mm).
25. C508: Swing-check Valves for Waterworks Service, 2 In. (50mm) Through 24 In. (600 mm) NPS.
27. C510: Double Check Valve Backflow-Prevention Assembly.
28. C511: Reduced-Pressure Principle Backflow-Prevention Assembly.
33. C606: Grooved and Shouldered Joints.
34. C651: Disinfecting Water Mains.
36. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fittings, 4 In. Through 12 In. (100mm Through 300mm) for Water Distribution.
37. C901: Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13mm) Through 3 In. (76mm) for Water Service.
38. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm) for Water Transmission and Distribution.
39. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) through 63 In (1,575 mm), for Water Distribution and Transmission.
40. C907: Polyvinyl Chloride (PVC) Pressure Fittings for Water – 4 In. through 8 In. (100 mm Through 200 mm).
44. M41: Ductile-Iron Pipe and Fittings.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.
C. AWWA: American Waterworks Association
D. DI: Ductile iron.
E. DIP: Ductile iron pipe.
F. FM: Factory Mutual.
H. NSF: National Sanitation Foundation.
J. PE: Polyethylene.
K. PVC: Polyvinyl Chloride.
L. UL: Underwriters Laboratory.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Internal Pressures: As indicated on plans.

B. External Load: Earth load indicated by depth of cover plus AASHTO H20 live load unless indicated otherwise.

1.6 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Product Data: For the following:
   1. Piping materials and fittings.
   2. Pipe couplings.
   3. Flexible pipe fittings.
   4. Restrained pipe fittings.
   5. High deflection fittings/ball joints.
   7. Flexible expansion joints.
   8. Gate valves.
  10. Check valves.
  11. Air and vacuum relief valves.
  13. Pressure reducing valves.
  14. Pressure sustaining valves.
  15. Ball valves.
  16. Fire hydrants.
  17. Post indicator valves.
  18. Fire department connections.
  20. Precast valve boxes and box covers.

C. Shop drawings: Include plans, elevations, details and attachments.
   1. Precast and cast in-place vaults and covers.
   2. Wiring diagrams for alarm devices.

D. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

1.7 QUALITY ASSURANCE
A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.

B. Comply with the following requirements and standards:

C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

1.8 MATERIAL DELIVERY, STORAGE AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.

B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.

C. Handling: Use slings to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. During Storage: Use precautions for valves, including fire hydrants according to the following.
   1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
   2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

E. Do not store plastic pipe and fittings in direct sunlight.

F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.

G. Protect linings and coatings from damage.

H. Handle precast boxes, vaults and other precast structures according to manufacturer’s written instructions.

I. Protect imported bedding and backfill material from contamination by other materials.
1.9 COORDINATION

A. Coordinate connection to existing water mains with water utility supplying water.

B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping.

PART 2 - PRODUCTS

2.1 SMALL-SIZE SERVICE PIPES

A. Copper Pipe: Sizes ¾-inch through 2-inch.
   2. Joints: Restrain by couplings.

B. PE Plastic Pipe: Sizes ½-inch through 3-inch.
   1. Pipe and Fittings: AWWA C901.
   2. Joints: Restrain with clamps or heat-fusion.

C. PVC Pipe: Sizes 1/8-inch through 3 inch.
   1. Pipe and Fittings: ASTM D 1785, Schedule 40

2.2 LARGE-SIZE SERVICE AND DISTRIBUTION PIPES

A. DIP: Sizes 4-inch through 48-inch.
   2. Fittings
      (a) Standard: AWWA C110, sizes 4-inch through 48-inch.
      (b) Compact: AWWA C153, sizes 4-inch through 24-inch.
   3. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
   4. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
   6. Unrestrained Joints:
      (a) Push-On Bell and Spigot Joint: AWWA C111.
      (b) Mechanical Joint: AWWA C111.
   7. Restrained Joints:
      (a) Flanged Joint: AWWA C115.
      (b) Push-On Bell and Spigot Joint: AWWA C111 with “Field Lok Gasket,” sizes 4-inch through 24-inch; “TR Flex,” sizes 4-inch through 64-inch; both by U. S. Pipe (Birmingham AL) (Tel.205-254-7442) or approved equal. “Megalug” restraint harness, Ebaa Iron (Eastland TX) (Tel 800-443-1716) or approved equal.
      (c) Mechanical Joint: AWWA C111 with “Mega Lug,” sizes 3-inch through 48-inch. Ebaa Iron (Eastland TX) (Tel 800-443-1716) or approved equal.
      (d) Grooved and Shouldered Joints: AWWA C150, AWWA C151 and AWWA C606. 24-inch maximum size.
   8. Couplings:
      (a) Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer’s shop coating with low alloy steel bolts and nuts. Steel couplings
to conform to AWWA C219. Smith-Blair, Inc, (Texarkana, AR) (Tel. 501-773-5127), Dresser (Bradford, PA) (Tel.-814-368-3131) or approved equal.

(b) Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer’s shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Smith-Blair, Inc, (Texarkana, AR) (Tel. 501-773-5127), Dresser (Bradford, PA) (Tel.-814-368-3131) or approved equal; or 2) restrained flange adapter, “Megaflange,” sizes 3-inch through 36 inch, Ebaa Iron (Eastland TX ) (Tel 800-443-1716) or approved equal.

B. PE Pipe: Sizes 4-inch through 64-inch.
   1. Pipe and Fittings: AWWA C906.
   2. Joints:
      (a) Thermal Butt Fusion: AWWA C906 and pipe manufacturer’s recommendations.
      (b) Flanged joining: AWWA C906 and pipe manufacturer’s recommendations.
      (c) Other: Check with pipe manufacturer.

C. PVC Pipe: Sizes 4-inch through 48-inch.
   1. Pipe:
      (a) 4-inch through 12-inch: AWWA C900.
      (b) 14-inch through 48-inch: AWWA C905.
   2. Fittings: DI conforming to 2.2A above.
   3. Unrestrained Joints:
      (a) Push-On Bell and Spigot Joint: AWWA C900.
   4. Restrained Joints:
      (a) Push-On Bell and Spigot Joint: Harness assembly as manufactured by Ebaa Iron (Eastland, Tx) (Tel. 800-433-1716) or approved equal.
      (b) Plain End PVC to DI Mechanical Joint: Ebaa Iron (Eastland, Tx) (Tel. 800-433-1716) or approved equal.
   5. Steel or Ductile Iron Couplings:
      (a) Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer’s shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. Smith-Blair, Inc, (Texarkana, AR) (Tel. 501-773-5127), Dresser (Bradford, PA) (Tel.-814-368-3131) or approved equal.
      (b) Plain End Pipe to DI or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer’s shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Smith-Blair, Inc, (Texarkana, AR) (Tel. 501-773-5127), Dresser (Bradford, PA) (Tel.-814-368-3131) or approved equal.
   6. PVC Couplings
      (a) Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by CertainTeed (Valley Forge, PA) (Tel. 610 341-6820) or approved equal.
      (b) Restrained Plain End to Plain End Pipe: AWWA C900, “Certa-Lock” as manufactured by CertainTeed (Valley Forge, PA) (Tel. 610 341-6820) or approved equal.
   7. Corrosion Protection
      (a) All ductile iron fittings shall be protected against corrosion with the installation of corrosion protection wrapping/coatings, Denso MB-50 Tape or approved equal.

D. Cement Mortar Lined and Coated Steel Pipe: 6-inch and larger.
   1. Pipe: AWWA C200 and AWWA M11.
   2. Special Sections and Fittings: AWWA C200, C207, C208 and AWWA M11 for all
4. Linings and Coatings for Pipe, Special Sections and Fittings: Cement Mortar Lining and Coating: AWWA C205.
   (a) Liquid Epoxy Lining and Coating: AWWA C210.
   (b) Fusion Bonded Epoxy Lining and Coating: AWWA C213.
   (c) Coal-Tar Lining and Coating: AWWA C203.
   (d) Cold-Applied Tape Coatings, Piping: AWWA C214.
   (e) Cold-Applied Tape Coatings, Specials, Connection and Fittings: AWWA C209.
   (f) Cold Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Buried or Submerged Steel Water Pipelines.
   (g) Aboveground Pipe Coatings: AWWA C218.
   (a) Rubber Gasket: Carnegie-shape rubber gasket as indicated.
6. Restrained Joints: AWWA M11. Where a flanged joint, butt strap or coupling are not indicated, either restrained joint a, or b, as follows, is acceptable, but the selected joint shall be used throughout the project.
   (a) Rubber Gasket: Carnegie-shape rubber gasket with field welded restraint bar as indicated.
   (b) Field Lap Welded Slip Joint: As indicated.
   (c) Field Welded Butt Strap: As indicated.
   (d) Flanged Joint: AWWA C207 with Type 316L stainless steel bolts and nuts as indicated.
7. Joint Coating for Cement Mortar Lined and Coated Steel Pipe:
   (a) Field Joint Encasement: Cement mortar contained in fabric lined with closed cell polyethylene foam as indicated. Attach fabric to pipe with Type 316L stainless steel straps as indicated. Closed cell polyethylene foam encasement shall be by Industrial Specialties (Fullerton, CA) (Tel. 800-638-8127) or approved equal.
8. Non-Restrained Flexible Couplings: AWWA C219, Smith Blair, Inc (Texarkana, TX) (Tel. 501-773-5127), Number 411 or approved equal, with factory applied fusion-bond epoxy coating and Type 316L stainless steel bolts and nuts.
9. Restrained Flexible Couplings: Non-restrained flexible coupling supplemented with a restraining harness as indicated and as follows:
   (a) Restraining harness design by Contractor’s pipe manufacturer using criteria presented in Section 13.10 of AWWA M11.
   (b) Space harness-lugs and tie bolts equally around the pipe.
   (c) Type 316L stainless steel harness tie bolts and nuts.
   (d) Design and dimensions of harness lugs to be modified from that shown in AWWA M11, as necessary, to provide additional height to clear the coupling.
10. Field Coating of Coupling Assemblies: Apply either of the following flexible tape and mastic or putty coating systems to the all non-restrained or restrained flexible steel couplings.
    (a) Denso Coating System – Denso North American, Inc., (Houston, TX), (Tel 281-821-3355).
    (b) Trenton Coating System – Allied Utility Products, (Livermore, CA) (Tel. 510-484-4007 or 510-373-7400).

2.3 HIGH DEFLECTION FITTINGS/BALL JOINTS
A. Plain End Pipe: Xtra Flex Restrained Joint High Deflection Fittings, 4-inch through 24-inch, U. S. Pipe, (Birmingham, AL) (Tel. 205-254-7442) or approved equal.

B. Mechanical or Flanged Joint: Flex 900, 4-inch through 12-inch, Ebaa Iron Sales, (Eastland, TX) (Tel. 800-433-1716) or approved equal.

2.4 EXPANSION JOINTS

A. TR Flex Joints: TR Flex Telescoping Sleeve, 4-inch through 64 inch, U. S. Pipe, (Birmingham, AL) (Tel. 205-254-7442).

B. Mechanical or Flanged Joint: Ex-Tend 200, 4-inch through 36-inch, EBAA Iron Sales, (Eastland, TX) (Tel. 800-433-1716) or approved equal.

2.5 FLEXIBLE EXPANSION JOINTS

A. Plain End to Plain End Pipe: “Xtra Flex,” sizes 4-inch through 24-inch, U. S. Pipe, (Birmingham AL) (Tel. 205-254-7442) or equal.

B. Flanged or mechanical Joint: “Flex-Tend,” sizes 3-inch through 48-inch, Ebaa Iron (Eastland TX) (Tel. 800-433-1716) or equal.

C. Flanged Joint: Starflex, Series 500, Star Pipe Products, (Tel. 800-999-3009) or equal.

2.6 GATE VALVES

A. Provide on lines 10-inch and smaller.

B. Valves, 3-Inch through 20-Inch: AWWA C509, resilient-seated, non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise. All bolts, nuts and washers, except operating nut, shall be stainless steel. Stem operating nut to be 2-inches square and open counter-clockwise. Stem extensions shall be installed to bring the stem operating nut to within 2-feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4-feet. Equip valves in pump stations and other interior or vault installations with hand-wheels. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer’s recommendations.

C. Service Line Valves and Fittings, 2-Inch and Smaller: AWWA C800

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Mueller Company (Decatur, IL) (Tel.800-423-1323).

E. Valve Box and Cover: 9-inch minimum diameter PCC box with extensions of length required for depth of bury of valve, and cast iron or ductile iron cover with lettering “WATER”. Both the box and the cover shall be rated for AASHTO H20 loading.
2.7 BUTTERFLY VALVES

A. Provide on lines larger than 10-inch.

B. Valves, 3-Inch through 72-Inch: AWWA C 504, rubber seated, Class 150B cast iron body, cast or ductile iron discs, stainless steel shafts, adjustable field replaceable rubber seats mating against stainless steel seat rings and field-replaceable seals. Flanged or mechanical joint end connections. No wafer type valves allowed. Traveling nut type valve actuators designed for buried service unless noted otherwise. All bolts, nuts and washers, except wrench nut, shall be stainless steel. Wrench nut to be 2-inches square and open counter-clockwise. Stem extensions shall be installed to bring the wrench nut to within 2-feet of finish grade where the depth from finish grade to the wrench nut exceeds 4-feet. Equip valves in pump stations and other interior or vault installations with hand-wheels. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer’s recommendations.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Mueller Company (Decatur, IL) (Tel. 800-423-1323).

D. Valve Box and Cover: 9-inch minimum diameter PCC box with extensions of length required for depth of bury of valve, and cast iron or ductile iron cover with lettering “WATER”. Both the box and the cover shall be rated for AASHTO H20 loading.

2.8 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES

A. AWWA C512, specific type of valve, size, details and valve box as indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Apco Valves, Valve and Primer Corporation (Schaumburg, IL) (Tel. 708-529-9000).
2. Crispin Valve (Berwick, PA) (Tel. 800-247-8258).

2.9 BLOW-OFF VALVES

A. Blow-off valve assemblies, details and boxes as indicated.

2.10 SWING CHECK VALVES

A. Valves 2-Inch through 24-Inch: AWWA C508, details as indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Mueller Company (Decatur, IL) (Tel.800-423-1323).

2.11 BALL VALVES

A. Valves 6-Inch through 48-Inch: AWWA C507, details as indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:

2.12 PRESSURE-REGULATING VALVES

A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250-psi Working-pressure, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment. Details as indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Cla-Val Company (Newport Beach, CA) (Tel. 714-548-2201).
   2. Bermad (Porterville, CA) (Tel. 209-781-6630).
   3. Ames Company (Woodland, CA) (Tel. 916-666-2493).

2.13 FLOW-REGULATING VALVES

A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250-psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment. Details as indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Cla-Val Company (Newport Beach, CA) (Tel. 714-548-2201).
   2. Bermad (Porterville, CA) (Tel. 209-781-6630).
   3. Ames Company (Woodland, CA) (Tel. 916-666-2493).

2.14 SERVICE CONNECTIONS AND WATER METERS

A. Service connections and water meter details and boxes as indicated.

2.15 FIRE HYDRANTS

A. Wet Barrel: AWWA C503, details as indicated.

B. Dry Barrel: AWWA C502, details as indicated.

2.16 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

A. Provide as indicated and as required by State or local agency.
B. General: AWWA C511, with OS gate valve on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves for continuous-pressure application.

C. Body:
   1. 2-Inch and Smaller: Bronze with threaded ends.
   2. 2-1/2-Inch and Larger: Bronze, cast iron steel, or stainless steel with flanged ends.

D. Interior Lining: AWWA C550, epoxy coating for cast iron or steel bodies.

E. Interior Components: Corrosion-resistant materials.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Cla-Val Company (Newport Beach, CA) (Tel. 714-548-2201).
   2. Ames Company (Woodland, CA) (Tel. 916-666-2493).
   3. Febco, CMB Industries, Inc. (Fresno, CA) (Tel. 559-252-0791).
   4. Hersey Products, Inc. (Dedham, MA) (Tel. 617-326-9400).

2.17 DOUBLE CHECK DETECTOR ASSEMBLY

A. FM approved or UL listed, with OS&Y gate valve on inlet and outlet, and strainer on inlet. Include two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous pressure application.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Cla-Val Company (Newport Beach, CA) (Tel. 714-548-2201).
   2. Ames Company (Woodland, CA) (Tel. 916-666-2493).
   3. Febco, CMB Industries, Inc. (Fresno, CA) (Tel. 559-252-0791).
   4. Hersey Products, Inc. (Dedham, MA) (Tel. 617-326-9400).

2.18 POST INDICATOR VALVE

A. General: UL 789, FM approved, vertical-type, cast-iron body with operating wrench extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve. Review fire department connection with agency having jurisdiction. Check hose threads and all sizes with fire department.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Mueller Co. (Decatur, IL) (Tel. 800-423-1323).
   2. Clow Corporation (Oskaloosa, IA).

2.19 FIRE DEPARTMENT CONNECTION
A. Exposed, Freestanding Fire Department Connection: UL 405, cast brass body with threaded inlets according to NFPA 1963 and matching local fire department hose threads and threaded bottom outlet. Include lugged caps, gaskets and chains; lugged swivel connections and drop clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate. Four 2-1/2-inch NPS inlets and 6-inch NPS outlet.

2.20 UNDERGROUND VAULTS/PITS

A. General: Portland cement concrete, precast or cast-in-place as indicated.

B. Portland Cement Concrete and Reinforcing Steel: Section 32 05 23 – Cement and Concrete for Exterior Improvements.

C. Access Openings: As indicated.

D. External Load: Earth load plus AASHTO H20 live load if located in paved areas.

E. Lids: Bolt down type.

2.21 TRACER WIRE

A. General: Minimum #12 AWG stranded copper wire with blue THW, THWN, or THHN rated insulation.

2.22 WARNING TAPE

A. General: Non-detectable 3-inch warning tape made of solid blue film with continuously printed black-letter message reading “CAUTION—WATER LINE BURIED BELOW.”

2.23 PCC THRUST BLOCKS

A. Portland Cement Concrete and Reinforcing Steel: Section 32 05 23 – Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer’s instructions, and in accordance with the following:
   1. DIP: AWWA M41 and AWWAC600.
   2. PVC pipe: AWWA M23 and AWWA C605.

B. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer’s recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Lay pipe on a bed of bedding material specified and prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance openings at the end of each days work or when work is not in progress.

3.2 CONNECTING TO EXISTING MAINS

A. Pressure Tap Connections: Perform in accordance with the requirements of the owner of the system being tapped. Maintain a positive pressure flow from the main being tapped to the tapping device to flush plastic chips, metal ribbons, etc. into the tapping devise and not into the pipe being tapped.

B. Other Connections: As indicated and in accordance with the requirements of the owner of the line being connected to.

3.3 ANCHORAGE INSTALLATION

A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer’s instructions.

B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24-hours curing time before introducing water into the pipeline and allow a minimum of 7-days curing time before pressure testing.

3.4 HIGH DEFLECTION FITTINGS/BALL JOINTS, EXPANSION JOINTS, AND FLEXIBLE EXPANSION JOINTS

A. Install as indicated and in accordance with the manufacturers recommendations.

3.5 VALVE INSTALLATION
A. Install all valves in accordance with the manufacturer’s instructions and the following:

1. General:
   (a) Gate Valves: Appendix A of AWWA C509.
   (b) Butterfly Valves: Appendix A of AWWA C504.

2. Joints:
   (a) Valves on DI, PE and PVC Pipe: Mechanical joint valves for buried locations. Flanged-end valves for installation in vaults/pits.
   (b) Valves on Steel Pipe: As indicated for buried locations. Flanged-end valves for installation in vaults/pits.

3.6 SERVICE CONNECTIONS INSTALLATION
   A. Install as indicated and in accordance with the requirements of the owner of the system.

3.7 WATER METER INSTALLATION
   A. Install as indicated and in accordance with the requirements of the owner of the system.

3.8 FIRE HYDRANT INSTALLATION
   A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

3.9 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER INSTALLATION
   A. Install as indicated and in accordance with the requirements of the owner of the system and the local health department requirements.

3.10 DOUBLE CHECK DETECTOR ASSEMBLY INSTALLATION
   A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

3.11 POST INDICATOR VALVE INSTALLATION
   A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

3.12 FIRE DEPARTMENT CONNECTION INSTALLATION
   A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

3.13 UNDERGROUND VAULT/PIT INSTALLATION
   A. Install as indicated.

   B. Excavation and Backfill: Section 31 23 33 – Trenching and Backfilling.
3.14 TRACER WIRE INSTALLATION

A. Install on trench bottom under the vertical projection of the pipe to protect it in all installations.

B. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance designated by the owner of the system or the Owner. Extend the wire up the outside of the valve box/riser and cut a hole that is 8-inches from the top, extend a 12-inch wire lead to the inside of the box. At other pipeline appurtenances, designated by the owner of the system or the Owner, terminate the 12-inch wire lead inside the enclosure.

C. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician’s tape.

3.15 WARNING TAPE INSTALLATION

A. Install tape approximately 1-foot above and along the centerline of the pipe.

B. Where tape is not continuous, lap tape ends a minimum of 2-feet.

3.16 HYDROSTATIC PRESSURE AND LEAKAGE TEST

A. General:
   1. Provide all necessary materials and equipment, including water.
   2. Backfill all trenches sufficient to hold pipe firmly in position.
   3. Allow time for thrust blocks to cure prior to testing.
   4. Flush all pipes prior to testing to remove all foreign material.
   5. Perform pressure and leakage test concurrently.
   6. Test pressure: See Subsection titled “System Performance Requirements.”
   7. Apply test pressure by means of a pump connected to the pipe.
   8. Base test pressure on the elevation of the lowest point in the line.
   9. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
   10. Allow water to stand in the pipe for 24 hours before test pressure is applied.
   11. Allow the system to stabilize at the test pressure before conducting the leakage test.
   12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
   13. Maintain test pressure as specified for type of pipe being tested.
   14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
   15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.
B. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:
1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. No piping will be accepted if the leakage is greater than that determined by the following formula:
   \[ L = \left( \frac{S \times D \times P^{1/2}}{133,200} \right) \]
   - \( L \) = Allowable leakage, gallons per hour.
   - \( S \) = Length of pipe tested, feet.
   - \( D \) = Nominal diameter of pipe, inches.
   - \( P \) = Average test pressure during the leakage test, pounds per square inch (gauge).

C. PE Pipe Leakage Test:
1. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
2. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for one to three hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.
3. Nominal Allowance for Expansion
   
<table>
<thead>
<tr>
<th>Pipe (in.)</th>
<th>1-Hour Test</th>
<th>2-Hour Test</th>
<th>3-Hour Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.10</td>
<td>0.15</td>
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<tr>
<td>4</td>
<td>0.13</td>
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<td>0.30</td>
<td>0.60</td>
<td>0.90</td>
</tr>
<tr>
<td>8</td>
<td>0.50</td>
<td>1.00</td>
<td>1.50</td>
</tr>
<tr>
<td>10</td>
<td>0.75</td>
<td>1.30</td>
<td>2.10</td>
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<tr>
<td>11</td>
<td>1.00</td>
<td>2.00</td>
<td>3.00</td>
</tr>
<tr>
<td>12</td>
<td>1.10</td>
<td>2.30</td>
<td>3.40</td>
</tr>
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<td>4.20</td>
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</tr>
<tr>
<td>40</td>
<td>11.00</td>
<td>22.00</td>
<td>33.00</td>
</tr>
</tbody>
</table>
D. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:

1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. No piping will be accepted if the leakage is greater than that determined by the following formula:
   \[ L = \frac{(N \times D \times P^{1/2})}{7,400} \]
   \( L \) = Allowable leakage, gallons per hour.
   \( N \) = Number of joints in the length of the pipeline tested.
   \( D \) = Nominal diameter of pipe, inches.
   \( P \) = Average test pressure during the leakage test, pounds per square inch (gauge).

E. Cement Mortar Lined and Coated Steel Pipe Leakage Test: Perform in accordance with AWWA M11. Selected requirements of AWWA M11 are repeated as follows:

1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. There shall be no significant leakage for pipe with welded joints or mechanical couplings.
3. For pipe joined with O-ring rubber gaskets, a leakage of 25 gallons per inch of diameter per mile per 24-hours is allowed.

3.17 DISINFECTION

A. All New Pipelines shall be disinfected in accordance with one of the three methods specified in AWWA C651 and the following:

1. Disinfect after pressure and leakage test have been performed and accepted.
2. The method used shall be at the Contractor’s option, unless specified by the owner of the water system.
3. Engage the services of a commercial testing laboratory, approved by the owner of the water system, to perform the bacteriological tests specified in Section 5.1 of AWWA C651. Direct the testing laboratory to send the original report of the bacteriological testing to the owner of the water system. Should the laboratory report show that any sample taken was not acceptable, repeat the sterilization process shall until a satisfactory sterilization is accomplished.
4. Lawfully dispose of the chlorinated water.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roadway and/or site sanitary gravity sewers and force mains up to 5 feet of any on-site building.

1.2 RELATED SECTIONS

A. Section 31 23 33 – Trenching and Backfilling.

B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

C. Section 33 05 16 – Utility Structures.

1.3 RELATED DOCUMENTS

A. AASHTO:

1. M 252: Corrugated Polyethylene Drainage Tubing.
2. M 294: Corrugated Polyethylene Pipe, 12 to 24-inch Diameter.

B. ASTM:

1. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
2. A 674 Practice for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids.
5. D 1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
10. D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. F-1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings.

C. AWWA:
3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water.

D. Caltrans Standard Specifications.
   1. Section 65, Reinforced Concrete Pipe.

E. California Building Code.

F. Section 1806A.11 – Pipes and Trenches.

G. California Plumbing Code.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.
E. HDPE: High-density polyethylene.
F. PE: Polyethylene.
G. DIP: Ductile iron pipe.
H. PVC: Polyvinyl Chloride.
I. RCP: Reinforced concrete pipe.
J. NPS: Nominal pipe size.

1.5 SUBMITTALS

A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

B. Product data for the following:
   1. Piping materials and fittings.
   2. Special pipe couplings.
   4. Sewage air relief valves.

C. Shop drawings: Include plans, elevations, details and attachments for the following:
   1. Force main piping access openings.
D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.

E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, fittings, and seals from dirt and damage.

C. Handle precast concrete pipe and other precast structures according to manufacturer’s written instructions.

D. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS FOR GRAVITY FLOW

A. ABS Pipe and Fittings: 4-inch through 12 inch, ASTM D 2751, SDR 35. Bell and spigot joints.

B. DIP: Sizes 4-inch through 48-inch.
   2. Pressure Class: Minimum pressure class for size indicated.
   3. Fittings
      (a) Standard: AWWA C110, sizes 4-inch through 48-inch.
      (b) Compact: AWWA C153, sizes 4-inch through 24-inch.
   4. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
   5. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
   7. Joints:
      (a) Push-On Bell and Spigot Joint: AWWA C111.
      (b) Mechanical Joint: AWWA C111.
      (c) Flanged joint. AWWA C115.

C. PE Pipe and Fittings (HDPE): 4-inch through 10-inch, AASHTO M252 Type S, smooth interior and corrugated exterior. Bell and spigot joints.
   2. Couplings: AASHTO M 252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint.

   2. Couplings: AASHTO M 252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint.
E. PVC Pipe:
   1. Pipe:
      (a) 4-inch through 15-inch: ASTM D 3034, SDR 35. Bell and spigot joints.
      (b) 18 inch through 36-inch: ASTM F 679, T-1 wall. Bell and spigot joints.
   2. Fittings:
      (a) 4-inch through 27-inch: ASTM F 1336.
      (b) 30-inch through 36-inch: ASTM D 3034, SDR 35

F. Reinforced Concrete Pipe: Designated by Class, rubber gasketed joints, Type II or V cement.
   2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-1.02B. Class HE-III and VE-III.

2.2 PIPING MATERIALS FOR FORCE MAINS

A. DIP: See Section 33 10 00 – Water Utilities.
B. PE Pipe: See Section 33 10 00 – Water Utilities.
C. PVC Pipe: See Section 33 10 00 – Water Utilities.

2.3 SPECIAL PIPE COUPLINGS

A. Gravity Piping: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.
B. Force Main piping: See Section 33 10 00 – Water Utilities.

2.4 MANHOLES AND CLEANOUTS

A. See Section 33 05 16 – Utility Structures.

2.5 SEWAGE AIR RELIEF VALVE ASSEMBLY FOR FORCE MAINS

A. General: As indicated.

2.6 THRUST BLOCKS FOR FORCE MAINS

A. General: Location, configuration bearing area, etc. as indicated.
B. Portland Cement Concrete: Section 32 05 23 – Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.1 GRAVITY PIPE INSTALLATION
A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer’s instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-1.07 for reinforced concrete pipe and chapter 11.3.3 of AWWA M41 for ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer’s recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance at the end of each day’s work or when work is not in progress.

3.2 FORCE MAIN PIPE INSTALLATION

A. General: See Section 33 10 00 – Water Utilities.

3.3 SPECIAL PIPE COUPLINGS

A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

B. Installation: Per manufacturer’s instructions.

3.4 AIR RELIEF VALVE ASSEMBLY INSTALLATION

A. General: Install as indicated.

3.5 TESTING OF GRAVITY PIPING MAINS

A. Obstructions: After backfilling and compacting, but before paving or other surface improvements, test sewer for obstructions either by rodding or by the sewer ball method. Provide for intercepting all grit, rocks and other flushed debris to keep debris from
entering the existing system.

B. At the option of the Contractor, either the following hydrostatic or air test shall be performed.

C. Hydrostatic Test:

1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
2. Test sewer mains between successive manholes by closing the lower end of the sewer main to be tested and the inlet sewer main of the upper manhole with stoppers.
3. Fill pipe and manholes with water to a point four feet below the ground surface of the upper manhole, but in no case less than four feet above the pipe invert. If ground water is present, the water surface at the upper manhole shall be at least four feet above the level of the ground water.
4. Fill piping at least one hour prior to testing.
5. Test piping at least two hours by maintaining the head specified above with measured additions of water. The sum of these additions of water, in the two-hour test period, shall be the leakage amount.
6. The maximum allowable head of water above any portion of sewer being tested shall be 15-feet. Where the difference in elevation between successive manholes exceeds 15-feet, a test tee shall be installed between manholes, and the testing shall be carried on between the tee and the manhole.
7. The allowable leakage shall not exceed 0.1-gallons per minute per inch diameter, per 1000-feet of sewer main being tested.
8. If the leakage exceeds the above amount, determine the cause and remedy it prior to retesting.
9. If the leakage is less than the allowable, but leaks are observed, repair the observed leaks.

D. Air Test:

1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
2. Apply to each length between adjacent manholes.
3. Supply pressure gauge with minimum divisions of 0.10-psi and with an accuracy of +/- 0.04-psi. When requested by the Owner, provide certification that the gauge has been tested for accuracy within the last six months by a reliable testing firm.
4. Pressurize the test section to 3.5-psi, and then hold the pressure above 3.0-psi during a saturation period of at least 5 minutes. At the end of the saturation period, note the pressure, which must be a minimum of 3.0-psi, and begin the timed period. If the pressure drops 0.5-psi in less than the time given in the following table the section of pipe has not passed the test.
5. Pipe Size | Minimum Time Allowed
---|---
4” | 125 seconds
6” | 185 seconds
8” | 245 seconds
10” | 310 seconds
12” | 370 seconds
### 3.6 TESTING OF LATERALS

A. At the option of the Contractor, either the following hydrostatic or air test shall be performed.

B. Hydrostatic Test:

1. Test laterals before backfilling.
2. Plug lateral at its ends and fill with water through the cleanouts.
3. Maintain the water level in the cleanouts as high as possible throughout the test period.
4. One hour after filling with water, examine the lateral for leakage.
5. Repair all leaks to the satisfaction of the Owner.
6. Do not backfill the trench until testing and repairs of the lateral are complete, and approved by the Owner.
7. Following approval of the Owner, remove all plugs, dispose of the water and complete the connection to the main.

C. Air Test

1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
2. Test in accordance with subsection above titled “Testing of Gravity Piping Mains,” paragraph titled “Air Test.”

### 3.7 HYDROSTATIC AND LEAKAGE TESTING OF FORCE MAINS

A. General: Perform hydrostatic and leakage test in accordance with Section 33 10 00 – Water Utilities.

**END OF SECTION**
SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Roadway and/or site storm drainage up to 5-feet of any on-site building.

1.2 RELATED SECTIONS
A. Section 31 23 33 – Trenching and Backfilling.
B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

1.3 RELATED DOCUMENTS
A. AASHTO:
   1. M 252: Corrugated Polyethylene Drainage tubing.
   2. M 294: Corrugated Polyethylene Pipe, 12 to 24-inch Diameter.
B. ASTM:
   2. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
   6. D 1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   11. D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
C. AWWA:
3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water.

D. Caltrans Standard Specifications:
1. Section 65, Reinforced Concrete Pipe.
2. Section 66, Corrugated Metal Pipe.
3. Section 70, Miscellaneous Facilities.
4. Section 72, Slope Protection.

E. Caltrans Standard Plans:
1. Plan D94A: Metal and Plastic Flared End Sections.
2. Plan D94B: Concrete Flared End Sections.
3. Plan D97A: Corrugated Metal Pipe Coupling Details No. 1, Annular Coupling Band Bar and Strap and Angle Connection.
4. Plan D97B: Corrugated Metal Pipe Coupling Details No. 2, Hat Band Coupler and Flange Details.
5. Plan D97C: Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers.
6. Plan D97D: Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands.
7. Plan D97E: Corrugated Metal Pipe Coupling Details No. 5, Standard Joint.
8. Plan D97F: Corrugated Metal Pipe Coupling Details No. 6, Positive Joint.
11. Plan D98B: Slotted Corrugated Steel Pipe Drain Details.

F. California Building Code:

G. Section 1806A.11 – Pipes and Trenches.

H. Section 1133B.7.2 – Gratings.

I. California Plumbing Code.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.


E. CMP: Corrugated metal pipe.
F. DIP: Ductile iron pipe.
G. HDPE: High-density polyethylene.
H. NPS: Nominal pipe size.
I. PE: Polyethylene.
J. PVC: Polyvinyl chloride.
K. RCP: Reinforced concrete pipe.

1.5 SUBMITTALS
A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
B. Product Data Shop Drawings, Etc.: For the following:
   1. Piping materials and fittings.
   2. Special pipe couplings.
   3. Polymer-concrete, channel drainage systems (trench drains).
   4. Joint sealants.
   5. Plastic area drains.
   6. Precast concrete catch basins, inlets, curb inlets, and area drains, including frames and grates.
   7. Concrete, metal and plastic flared end sections.
C. Design Mix Reports and Calculations: For each class of cast in place concrete.
D. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING
A. Do not store plastic structures, pipe and fittings in direct sunlight.
B. Protect pipe, fittings, and seals from dirt and damage.
C. Handle precast concrete pipe and other precast structures according to manufacturer’s written instructions.
D. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS
2.1 PIPING MATERIALS

B. ABS Pipe and Fittings: 4-inch through 12 inch, ASTM D 2751, SDR 35. Bell and spigot joints.

C. Cast Iron Pipe and Fittings: Hub and spigot, 2-inch through 15-inch, ASTM A74, service class.
   1. Gaskets: ASTM 564, rubber, compression type, thickness to match class of pipe.

   2. Bituminous Lining: Caltrans Standard Specification Section 66-1.03.

E. DIP: Sizes 4-inch through 48-inch.
   2. Pressure Class: Minimum pressure class for size indicated.
   3. Fittings:
      (a) Standard: AWWA C110, sizes 4-inch through 48-inch.
      (b) Compact: AWWA C153, sizes 4-inch through 24-inch.
   4. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
   5. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
   7. Joints:
      (a) Push-On Bell and Spigot Joint: AWWA C111.
      (b) Mechanical Joint: AWWA C111.
      (c) Flanged joint. AWWA C115.

F. Reinforced Concrete Pipe: Designated by Class, rubber gasketed joints.
   2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-1.02B. Class HE-III and VE-III.
   3. Reinforced Concrete Pipe Arch: Caltrans Standard Specification Section 65-1.02C.
G. PE Pipe and Fittings: 4-inch through 10-inch, AASHTO M 252 Type S, smooth interior and corrugated exterior. Bell and spigot joints.
   2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.

   2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.

I. PVC Pipe and Fittings—Smaller than 4-Inch: ASTM D1785, Schedule 40.
   1. Joints: Solvent Cement, ASTM D 2564. Include primer according to ASTM F656.

J. PVC Pipe and Fittings, 4-Inch and Larger
   1. Pipe:
      (a) 4-inch through 15-inch: ASTM D 3034, SDR 35. Bell and spigot joints.
      (b) 18 inch through 36-inch: ASTM F 679, T-1 wall. Bell and spigot joints.
   2. Fittings:
      (a) 4-inch through 27-inch: ASTM F 1336.
      (b) 30-inch through 36-inch: ASTM D 3034, SDR 35

2.2 PIPE ANCHORS
A. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

2.3 SPECIAL PIPE COUPLINGS
A. Plastic, Cast Iron and Ductile Iron Pipe: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

B. Reinforced Concrete Pipe: Portland cement concrete collar as indicated.

C. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

2.4 CURB INLETS, CATCH BASINS, DROP INLETS, AREA DRAINS, ETC.
A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.

B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

C. Precast Structure: Rate for AASHTO H20 loading in paved areas.
D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091).

E. Frames, Grates and Covers: Caltrans Standard Specification Section 75-1.02, 75-1.03 and 75-1.05.
   1. Galvanize steel frames, grates and covers.
   2. Grates and covers shall be non-rocking, bolt-down type.
   3. Rate for AASHTO H20 loading in paved areas.

2.5 MANHOLES AND CLEANOUTS
   A. See Section 33 05 16 – Utility Structures.

2.6 POLYMER-CONCRETE TRENCH DRAINS
   A. General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.
   B. Include the following components:
      1. Channel Sections: Interlocking-joint, precast modular units with end caps. Inside width as indicated with deep, rounded bottom, with built in slope or flat invert as indicated and outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
      2. Frame and Grate: Gray iron, ductile iron or galvanized steel as indicated. Where drain is located in traffic areas, rate for AASHTO H20 loading.
   C. Locking Mechanism: Manufacturer’s standard device for securing grates to channel sections.
   D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
      1. “Polydrain” by ABT Inc. (Troutman, NC) (Tel 704-528-9806).
      2. “ACO Drain” by ACO Polymer Products Inc. (Chardon, OH) (Tel. 800-543-4764).

2.7 METAL, CONCRETE OR PLASTIC FLARED END SECTIONS
   A. General: Caltrans Standard Specification Section 70-1.02C and Caltrans Standard Plan D94A and D94B.

2.8 SLOPE PROTECTION
      1. Class: [Select Class applicable to the Project.]

B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-4.03.
   2. Welded Wire Fabric: Caltrans Standard Specification Section 52-1.02C. Use 6 x 6-W1.4 xW1.4 unless otherwise indicated.

   1. Class: [Select Class applicable to the Project.]

D. Sacked Concrete Slope Protection.
   2. Sacks: 10 ounce burlap measuring approximately 19.5-inches by 36 inches when empty and laid flat.

2.9 CONCRETE/SHOTCRETE DITCH LINING

A. General: Caltrans Standard Specification Section 72-4.03.
   2. Welded Wire Fabric: Caltrans Standard Specification Section 52-1.02C. Use 6 x 6-W1.4 xW1.4 unless otherwise indicated

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer’s instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-1.07 for reinforced concrete pipe, Caltrans Standard Specification Sections 66-1.045 and 66-105 for corrugated metal pipe and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer’s recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by
handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance openings at the end of each days work or when work is not in progress.

3.2 INSTALLATION OF PIPE ANCHORS
A. Install at location, configuration and details shown on the Plans.

3.3 SPECIAL PIPE COUPLINGS
A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
B. Installation: Per manufacturer's instructions.

3.4 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, AREA DRAINS, ETC.
A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
   1. Shape bottoms to convey flows as indicated.
C. Precast Structures: Install as indicated.
   1. Seal all joints and pipe entrances and exits.
   2. Place concrete in bottom and shape to convey flows as indicated.

3.5 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION
A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
B. Install: As indicated and in accordance with the manufacturer’s instructions.

3.6 CONCRETE OR PLASTIC FLARED END SECTION INSTALLATION
A. Install: As indicated.

3.7 SLOPE PROTECTION PLACEMENT

A. Rock Slope Protection: Caltrans Standard Specification Section 72-2.03 and as indicated.
   1. Use Method B Placement unless otherwise indicated.

B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-4.02 and 72-4.04.

C. Concreted-Rock Slope Protection: Caltrans Standard Specification Section 72-5.03 and 72-5.04.
   1. Use Method B Placement unless otherwise indicated.

D. Sacked Concrete Slope Protection.
   1. Detailed configuration: As indicated.
   2. Use one cubic foot of concrete per sack.
   3. Locate headers and stretchers as indicated.
   5. Stretchers: Folded ends are not to be adjacent.
   6. Place no more than four vertical courses until initial set has taken place in first course.

3.8 CONCRETE/SHOTCRETE DITCH LINING PLACEMENT

A. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-4.02 and 72-4.04.

3.9 TESTING

A. General: Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
   4. Submit separate reports for each test.
   5. Where authorities having jurisdiction do not have published procedures, perform tests in accordance with latest edition of the Uniform Plumbing Code (UPC) Section 1109.0, Testing.
   6. Leaks and loss in test pressure constitute defects that must be repaired.
   7. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION
SECTION 33 46 00
SUBDRAINAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Subdrains in trenches and subdrains or prefabricated composite drainage panels at walls or foundations.

B. Sand-Swale filters in parking lot areas.

1.2 RELATED SECTIONS

A. Section 31 23 33 – Trenching and Backfilling.

B. Section 33 05 16 – Utility Structures.

C. Section 33 40 00 – Storm Drainage Utilities.

1.3 RELATED DOCUMENTS

A. AASHTO:

1. M 252: Corrugated Polyethylene Drainage Tubing.


B. ASTM:


2. D 448: Classification for Sizes of Aggregate for Road and Bridge Construction.


4. D 1785: Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.


10. D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

C. Caltrans Standard Specifications:
   1. Section 68-Subsurface Drains
   2. Section 88-Engineering Fabrics

1.4 DEFINITIONS
   A. AASHTO: American Association of State Highway and Transportation Officials.
   B. ABS: Acylonitrile-Butadiene-Styrene.
   E. HDPE: High-density polyethylene.
   F. PE: Polyethylene.
   G. PVC: Polyvinyl Chloride.

1.5 SUBMITTALS
   A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
   B. Product data for the following:
      1. Perforated pipe and fittings.
      2. Solid pipe and fittings.
      3. Prefabricated composite drainage panels.
   C. Samples:
1. Drainage Fill.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not store plastic structures, pipe, and fittings in direct sunlight.
B. Protect pipe, pipe-fittings, and seals from dirt and damage.
C. Protect permeable material from contamination by other materials.

PART 2 - PRODUCTS

2.1 PERFORATED WALL AND SOLID WALL PIPE

B. ABS Pipe and Fittings: 4-inch through 12-inch, ASTM D 2751, SDR 35. Bell and spigot joints.
C. PE Pipe and Fittings (HDPE): 4-inch through 10-inch, AASHTO M252 Type S (Solid wall.) or SP (Perforated wall.), smooth interior and corrugated exterior. Bell and spigot joints.
   2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
D. PE Pipe and Fittings (HDPE): 12-inch through 48-inch, AASHTO M 294.Type S (Solid Wall.) or Type SP (Perforated wall.), smooth interior and corrugated exterior. Bell and spigot joints.
   2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
1. Solvent Cement: ASTM D 2564. Include primer according to ASTM F656.

F. PVC Pipe and Fittings:
   3. Fittings: ASTM F 1336.

2.2 SPECIAL PIPE COUPLINGS
   A. Description: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.3 CLEANOUTS
   A. See 33 05 16 – Utility Structures.

2.4 PREFABRICATED COMPOSITE DRAINAGE PANELS
   A. Description: Prefabricated composite panels, 36 to 60-inches wide and manufactured with geotextile facing laminated to molded drainage core.
   B. Drainage Core: Three-dimensional, non-biodegradable, molded Polypropylene or Polystyrene.
      1. Minimum Compressive Strength: 10,000-lbf./sq. ft. when tested according to ASTM D 1621.
      2. Minimum Flow Rate: 7 gpm per foot at hydraulic gradient of 0.1 and compressive stress of 25 psig when tested according to ASTM D 4716.
   C. Geotextile: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M 288.
      1. Survivability Class: 2.
      2. Apparent Opening Size: No. 60 sieve maximum.
      3. Permittivity: 0.2 per second, minimum.
   D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
      1. American Wick Drain Corporation (Matthews, NC).
      2. Mirafi Inc. (Charlotte, NC) (Tel. 800-438-1855).
4. Phillips Fibers Corporation (Greenville, SC) (Tel. 800-845-5737).

2.5 DRAINAGE FILL MATERIAL

   1. Class 2
   B. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Sieve No. 57, with 100 percent passing 1-1/2-inch sieve and not more than 5 percent passing No. 8 sieve.

2.6 FILTER FABRIC

A. When required, use filter fabric for encasing permeable material around subdrains.
   2. Mirafi 140N (Mirafi Inc., Charlotte, NC) (Tel. 800-438-1855) or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
B. Install only after unsatisfactory conditions have been corrected.

3.2 PIPING APPLICATIONS

A. Refer to Plans for location, size, and material designation for individual subdrains.

3.3 INSTALLATION OF PERFORATED PORTIONS OF SUBDRAINS

A. Excavation: Section 6 of ASTM D 2321 and as indicated.
B. Subdrain Bedding: Place supporting layer of drainage fill over compacted subgrade to compacted depth indicated. If drainage fill requires encasement in filter fabric, lay filter fabric in trench and overlap trench sides before installing drainage fill.
C. Piping Installation: Install pipe in accordance with Section 7 of ASTM D 2321. Install piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Excavate recesses for bottoms of bell ends of pipe. Lay pipe with bells facing upslope and with spigot end centered fully into adjacent bell. Bed piping with full pipe bearing in drainage fill material. Lay perforated pipe with perforations down. Install gaskets, seals, sleeves, and couplings in accordance with manufacturers
written instructions. Use increasers, reducers, and couplings made for different sizes of materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

D. Initial Subdrain Backfill: After installing drainage piping, add drainage fill up to top of pipe to perform tests.

E. Testing Subdrain: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling with drainage fill. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

F. Subsequent Subdrain Backfill: After satisfactory testing, cover piping with drainage fill to width and height indicated. Place drainage fill in layers not exceeding 3 inches in loose depth; compact each layer placed. If filter fabric is required complete the filter fabric encasement by bringing fabric to top and closing the encasement.

G. Fill to Grade: Place native fill material over compacted drainage fill to thickness indicated. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish elevations unless otherwise specified on the plans.

3.4 INSTALLATION OF NON-PERFORATED PORTIONS OF SUBDRAINS

A. Conform to Section 31 23 33 – Trenching and Backfilling, and Section 33 46 00 – Storm Drainage Utilities.

3.5 PREFABRICATED COMPOSITE DRAINAGE PANELS

A. Coordinate placement with other drainage materials.

B. Install prefabricated drainage panels in accordance with manufacturer’s instructions.

C. Place perforated drainage pipe at base of footing and attach to composite drainage panels in accordance with the manufacturer’s instructions.

3.6 JOINING PIPE

A. Join ABS and PVC pipe and fittings with elastomeric seals according to ASTM D 2321 or solvent cement.

B. Special pipe couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.7 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION