CONTRA COSTA COMMUNITY COLLEGE

P-4006 District Office Seismic Retrofit

District Office
Date: March 15, 2019

NOTICE TO ALL CONTRACTORS

You are hereby notified of the following changes, clarifications and/or modifications to the original Contract Documents, Project Manual, Drawings, Specifications and/or previous Addenda. This Addendum shall supersede the original Contract Documents and previous Addenda wherein it contradicts the same, and shall take precedence over anything to the contrary therein. All other conditions remain unchanged. This Addendum forms a part of the Contract Documents and modifies the original Contract Documents dated February 2019. Acknowledge receipt of this Addendum in space provided on the Bid Proposal Form. Failure to acknowledge may subject Bidder to disqualification.

A. CHANGES AND/OR CLARIFICATIONS TO THE PROJECT MANUAL, CONTRACT DOCUMENTS AND SPECIFICATIONS:

Item (1) Refer to Project Manual:

REPLACE Specification Section 23 00 00 Mechanical General in its entirety as attached to this addendum.

REPLACE Specification Section 23 05 00 Mechanical in its entirety as attached to this addendum.

REPLACE Specification Section 23 09 00 Direct Digital Controls for Mechanical in its entirety as attached to this addendum.

ADD Specification Section 01 91 13 Commissioning in its entirety as attached to this addendum.
ADD Specification Section 01 91 16 Functional Performant Testing Procedures in its entirety as attached to this addendum.

ADD Specification Section 02 81 00 Hazardous Materials Remediation in its entirety as attached to this addendum.

ADD Specification Section 23 08 10 Commissioning of HVAC System Supplement in its entirety as attached to this addendum.

ADD Specification Section 28 00 00 Basic Security Requirements in its entirety as attached to this addendum.

ADD Specification Section 28 05 13 Security System Cabling in its entirety as attached to this addendum.

ADD Specification Section 28 05 53 Security System Labeling in its entirety as attached to this addendum.

ADD Specification Section 28 08 00 Security System Acceptance Testing in its entirety as attached to this addendum.

ADD Specification Section 28 13 00 Access Control and Alarm Monitoring System in its entirety as attached to this addendum.

ADD Specification Section 31 20 00 Earthwork in its entirety as attached to this addendum.

Item (2) Refer to Project Manual, Table of Contents:

ADD Specification Section 01 91 13 Commissioning.

ADD Specification Section 01 91 16 Functional Performant Testing Procedures

ADD Specification Section 02 81 00 Hazardous Materials Remediation

ADD Specification Section 23 08 10 Commissioning of HVAC System Supplement

ADD Specification Section 28 00 00 Basic Security Requirements

ADD Specification Section 28 05 13 Security System Cabling

ADD Specification Section 28 05 53 Security System Labeling

ADD Specification Section 28 08 00 Security System Acceptance Testing

ADD Specification Section 28 13 00 Access Control and Alarm Monitoring System

ADD Specification Section 31 20 00 Earthwork.
Item (3) Refer to Project Manual, Specification Section 06 20 00 Finish Carpenter,
Part 2 - Products, 2.3 Standing and Running Trim:

ADD the following in its entirety:

B. Adhesive Applied Wall Planks manufactured by WallPlanks, Inc.
   1. Color: Almond
   2. Width: 5.1 inches wide face 100% real wood veneer.
   3. Texture: Wire Brushed
   4. Finish: Three coats of polyurethane UV cured top coat
   5. Sheen: Low Gloss 4 to 6 percent.
   6. Adhesive: Peel & Stick vaccu-bond adhesive preapplied to the back of every plank.
   7. Edge Profile: Overlapping Shiplap on long sides of each board
   8. Length: 12 inches to 48 inches with over 80% full length boards.
   9. Top Layer Thickness: 0.8 mm.
   10. Core: HDF Core (100% real wood) made with 100% recycled forest content. Core density is 57 lbs per cubic foot; swelling coefficient 6%.
   11. Bottom Layer Thickness: 0.8 mm.
   12. Thickness: .25 inches total
   13. Construction: Three ply engineered construction with hardwood top veneer, wood fiber core, and hardwood bottom veneer.
   14. Veneer Grade: #1 common and better, sliced and spliced veneer.
   15. Warranty: Free from manufacturing defects for a period of 10 years.
   16. Installation: Follow manufacturer’s instructions utilizing recommended cleaning method prior to installation. The use of a J-roller is required to provided and insure the bond.

Item (4) Refer to Project Manual, Specification Section 01 03 00 Alternates,
Part 2 - Products, 2.1 Description of Alternates:

REVISE Items 1 and 2. To read as follows:

2.1 DESCRIPTION OF ALTERNATES

1. Main Entry Eyebrow – Delete the eyebrow entry element as shown on A3001 Exterior Elevations. The lower metal overhang and aluminum letters to remain. Associated details 1 and 2 on sheet A8202 will not be used. HSS8x8 and associated details for framing of the wing wall and eyebrow as shown on foundation plans, framing plans, detail 6 Sheet S5.1, and details 1, 2, 3, and 5 on sheet S7.1 will not be used. Delete power supply to bulletin board as shown on sheet E2.1. Light fixtures shown in the upper eyebrow shall be installed in the lower framed soffit.

2. Cable Railing System – Replace the cable railing system at floors 3 through 6 with a glass railing system. The basis for design for the glass rail system shall be equal to CR Lawrence Co. Inc.; CRL FSC Frameless Glass Clamp Railing System for 9/16” Laminated Tempered Glass. Glass panels are supported by surface mounted Duplex 2205 Marine Grade Stainless Steel Clamps.
B. CHANGES AND/OR CLARIFICATIONS TO THE DRAWINGS:

LANDSCAPE

Item (L01) Refer to Sheet L1.00 Site Demolition Plan:

**ADD** Note 9 at the tree located south of the Electrical Generator Enclosure.
**REVISE** Keynote 28 to read as 29 at electrical box located north of the Electrical Generator Enclosure.

ARCHITECTURAL

Item (A01) Refer to Drawings:

**ADD** Sheet M5002 Controls - Mechanical as attached to this addendum.

Item (A02) Refer to Sheet G1000 General Notes, Sheet Index:

**REVISE** Sheet Number A1102 to read as A1100.
**REVISE** Sheet Number A1103 to read as A1101.

**ADD** Sheet M5002 Controls - Mechanical

Item (A03) Refer to Sheet G1000 General Notes, Alternates:

**ADD** the following:

1. Main Entry Eyebrow – Delete the eyebrow entry element as shown on A3001 Exterior Elevations. The lower metal overhang and aluminum letters to remain. Associated details 1 and 2 on sheet A8202 will not be used. HSS8x8 and associated details for framing of the wing wall and eyebrow as shown on foundation plans, framing plans, detail 6 Sheet S5.1, and details 1, 2, 3, and 5 on sheet S7.1 will not be used. Delete power supply to bulletin board as shown on sheet E2.1. Light fixtures shown in the upper eyebrow shall be installed in the lower framed soffit.

2. Cable Railing System – Replace the cable railing system at floors 3 through 6 with a glass railing system. The basis for design for the glass rail system shall be equal to CR Lawrence Co. Inc.; CRL FSC Frameless Glass Clamp Railing System for 9/16” Laminated Tempered Glass. Glass panels are supported by surface mounted Duplex 2205 Marine Grade Stainless Steel Clamps.

Item (A04) Refer to Sheet G1000 General Notes, Scope of Work:

**REVISE** item 3. To read as follows:
3. Minor Alterations to the Fourth Floor Restrooms and Sixth Floor Restrooms.
4. The scope of work regarding the update to the elevator controls to meet current accessible code is occurring under a separate contract.
5. Flooring for elevator shall be provided under this contract and installed by others.

Item (A05) Refer to Sheet G1100 Code Analysis Site Plan:

ADD curb ramp as shown on the attached addendum site plan drawings AD2 A01 and per details as shown of drawings AD2 A02 and AD2 A03.

Item (A06) Refer to Sheet A2301, First Level Floor Plan, A2302 Second Level Floor Plan, A2303 Third Level Floor Plan, A2304 Fourth Level Floor Plan, A2305 Fifth Level Floor Plan, A2306 Sixth Level Floor Plan:

ADD the following note:

NOTE:

The scope of work regarding the update to the elevator controls to meet current accessible code is occurring under a separate contract.

Flooring for elevator shall be provided under this contract and installed in elevator cab under review by contractor performing scope of elevator work.

Item (A07) Refer to Sheet A2302 Second Level Floor Plan:

DELETE the installation of double doors 201A in the existing single door opening.

DELETE Plan 2 Enlarged Demo Plan.

DELETE Plan 3 Enlarged Plan.

Item (A08) Refer to Sheet A2303 Third Level Floor Plan, A2304 Fourth Level Floor Plan, A2305 Fifth Level Floor Plan, A2306 Sixth Level Floor Plan:

ADD the following note:

ALTERNATE:

Base Bid includes a Cable Railing System. Alternate Number 2 replace the cable railing system at floors 3 through 6 with a glass railing system. The basis for design for the glass rail system shall be equal to CR Lawrence Co. Inc.; CRL FSC Frameless Glass Clamp Railing System for 9/16” Laminated Tempered Glass. Glass panels are supported by surface mounted Duplex 2205 Marine Grade Stainless Steel Clamps.

Item (A09) Refer to Sheet A2304 Fourth Level Floor Plan and Enlarged Plans:
ADDENDUM # 2

DELETE all work shown regarding the addition of Office 420 and Office 421. Creating offices on the fourth floor is not in contract.

DELETE Plan 4 Fourth Level – Partial Reflected Ceiling Plan in its entirety.

Item (A10) Refer to Sheet A3001 Exterior Elevations:

ADD exterior elevations shown on attached addendum drawing sheets AD2 A07. These elevations shall be the base bid elevations.

ADD note at North Elevation and West Elevations as follows:

NOTE: CONTRACTOR SHALL PROVIDE PROPOSED LAYOUT OF CONSTRUCTION JOINTS FOR APPROVAL PRIOR TO INSTALLATION.

Item (A11) Refer to Sheet A3001 Exterior Elevations and A3002 Exterior Elevations:

ADD the following notes:

ALTERNATE:

1. Main Entry Eyebrow – Delete the eyebrow entry element as shown on A3001 Exterior Elevations. The lower metal overhang and aluminum letters to remain. Associated details 1 and 2 on sheet A8202 will not be used. HSS8x8 and associated details for framing of the wing wall and eyebrow as shown on foundation plans, framing plans, detail 6 Sheet S5.1, and details 1, 2, 3, and 5 on sheet S7.1 will not be used. Delete power supply to bulletin board as shown on sheet E2.1. Light fixtures shown in the upper eyebrow shall be installed in the lower framed soffit.

2. Cable Railing System – Replace the cable railing system at floors 3 through 6 with a glass railing system. The basis for design for the glass rail system shall be equal to CR Lawrence Co. Inc.; CRL FSC Frameless Glass Clamp Railing System for 9/16” Laminated Tempered Glass. Glass panels are supported by surface mounted Duplex 2205 Marine Grade Stainless Steel Clamps.

Item (A11) Refer to Sheet A3002 Exterior Elevations:

REVISE as shown on attached addendum drawing AD2-04.

Item (A12) Refer to Sheet A4003 Sections, Details 7, Detail 9 and Detail 24:

ADD flashing to details as shown on attached addendum drawing AD2-04.

Item (A13) Refer to Sheet A6001 Interior Elevations:

REVISE details at elevation 101 S to read as sheet number A8201 Wall Details.

ADDENDUM NO. TWO - Page 6
Contra Costa Community College District – 16144.000
P-4006 District Office
Seismic Upgrade
Item (A14)  Refer to Sheet A8501 Interior Details:

REVISE Detail 11 as shown on attached addendum drawing sheet AD2-A06.
REVISE Detail 12 as shown on attached addendum drawing sheet AD2-A05.
REVISE Detail 14 to read “Quartz Countertop” and “Quartz Vertical Surface” and “Plastic Laminate Vertical Surface on Reception Side”.
REVISE Detail 15 to read “Quartz Countertop” and “Quartz Vertical Surface”.
REVISE Detail 16 as shown on attached addendum drawing sheet AD2-A06.
REVISE Detail 18 to read “Quartz Countertop with Backsplash and Side Splashes”
DELETE Note 3. at Detail 18.
REVISE Detail 20 to read “Quartz Countertop” and “Quartz Vertical Surface”.
ADD Detail 28 as shown on attached addendum drawing sheet AD2-A05.

ELECTRICAL

Item (E01)  Refer to Sheet E1.1 Electrical Demolition Plan – First Floor:

REVISE the Demolition Sheet Notes as shown on the attached addendum drawing sheet AD2-ESK-1.

Item (E02)  Refer to Sheet E1.2 Enlarged Electrical Restroom Demolition Plan – Sixth Floor:

REVISE the Sheet Notes as shown on the attached addendum drawing sheet AD2-ESK-2.

Item (E03)  Refer to Sheet E2.1 Electrical Data Plan – First Floor:

REVISE the Electrical Plan as shown on the attached addendum drawing sheet AD2-ESK-3.

REVISE the General Notes as shown on the attached addendum drawing sheet AD2-ESK-4.

ADD the following note:

NOTE:

Key Card Readers shall be located at the locations shown on the attached addendum drawing sheet AD2-ESK5. See specification for additional requirements. Provide j-box rough in and home run conduit to the access control head end equipment. Coordinate with District for headend equipment exact location as required.
PRE BID QUESTIONS

PB RFI 1 QUESTION: The mechanical drawings show the new Mitsubishi VRF HVAC System connecting to the existing campus BMS system. Who is the campus BMS controls contractor? Or is this system meant to be a stand alone system? Please advise. The plans and specs do not appear to provide this information.

RESPONSE: These questions have been addressed within this addendum.

CONFORMANCE WITH CONTRACT DOCUMENTS, PROJECT MANUAL, DRAWINGS AND SPECIFICATIONS

All addenda work shall be in strict conformance with the Contract Documents, Project Manual, Drawings and Specifications as they pertain to work of a similar nature.

IBI Group

BY: [Signature]
Sharon A Russo, AIA  C27345

If you have any questions regarding this Addendum, please contact:
Ben Cayabyab, Contracts Manager
Contra Costa Community College District
500 Court St., Martinez, CA 94553
Email: bcayabyab@4cd.edu

All other terms and conditions of BID are to remain the same.

END OF ADDENDUM #2
SECTION 23 00 00
MECHANICAL GENERAL

PART I - GENERAL

1.1 GENERAL

A. The General Conditions and Supplementary General Conditions are hereby a part of this Section as fully as if repeated herein.

1.2 SCOPE

A. The work includes, but is not necessarily limited to, the furnishing of all labor, materials, equipment, and services necessary for, and reasonably incidental to, providing and installing complete heating, ventilating, and air conditioning systems, and other mechanical work as shown or indicated in the Drawings and Specifications.

B. Consult all other Sections to determine the extent and character of this work specified elsewhere.

C. Specifically refer to the following:

   Section 22 00 00   Plumbing General
   Section 22 05 00   Plumbing
   Section 23 05 00   Mechanical

D. Make all connections to equipment requiring service from systems installed under this Section.

1.3 COORDINATION

A. Before submitting a bid for the mechanical work the Contractor shall visit the site and become familiar with all the work on other related Drawings and Specifications, and plan the work to provide the best possible assembly of the combined work of all trades. No additional costs will be considered for work which has to be relocated due to conflicts with other trades.

B. If, after examination of the bidding documents relating to the work, the Contractor has queries concerning the nature and scope of the work or intent of the Specifications, he/she shall promptly request clarification from the Architect. After contract award, claims of ignorance of the intent and scope of the contract shall not be allowed.

C. At the start of the project, Mechanical Contractor shall schedule a coordination meeting between Mechanical, Plumbing, and Electrical sub-contractors at a minimum. Architect, Mechanical, Plumbing and Electrical Engineers shall be notified of the meeting time and location. Meeting shall review voltage and phase available at site and power requirements for each piece of equipment. Control and starter requirements for each piece of equipment including confirmation as to
who is providing equipment. Location of each piece of equipment, including rooftop units, motorized dampers, thermostats, switches, all control panels, and any and all equipment requiring coordination between trades. Minutes of the meeting shall be recorded and forwarded to the Architect, Mechanical, Plumbing and Electrical Engineers and sub-contractors, whether present at the meeting or not.

D. Contractor is responsible for coordinating the schedule of inspections by Engineer at appropriate stages of construction such as rough-in, pre-final, and final, and at other times required by the Specifications or by the construction. Notify Architect and Engineer seven (7) days in advance of proposed site visit. Notification constitutes certification that construction is, or will be, complete and ready for inspection.

1.4 SAFETY

A. Contractors must conduct a weekly safety meeting with their employees and provide documentation as to attendance and topics of discussion. Engineer’s construction support services do not constitute review or approval of Contractor’s safety procedures. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities within Contractor’s Scope of Work.

1.5 BUILDING LAWS

A. Mechanical work shall conform to all requirements prescribed by governmental bodies having jurisdiction and is to be in accordance with the California Building Code; all federal, state, and local codes and ordinances; all OSHA requirements; California Plumbing Code, California Mechanical Code, California Fire Code, and National Fire Protection Association; California State Code Title 8, Title 21, Title 24; and the Energy Conservation Standards.

B. Should any part of the design fail to comply with such requirements, the discrepancy shall be called to the attention of the Architect prior to submitting bid.

C. Should there be any direct conflict between the Drawings and/or Specifications and the above rules and regulations, the rules and regulations shall take precedence. However, when the indicated material, workmanship, arrangement, or construction is of a superior quality or capacity to that required by above rules and regulations, the Drawings and/or Specifications shall take precedence. Rulings and interpretations of enforcing agencies shall be considered as part of the regulations.

D. After a Contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on Drawings or overtly covered in the Specifications, they must be included at the Contractor's expense.

E. The Contractor is responsible to coordinate and make adjustments in his/her work with the full set of Contract Drawings and Specifications.
F. All piping, ducts, and equipment shall be securely anchored to building structure as required herein and by the California Building Code.

1.6 PAINTING

A. See Division 09 for painting of ductwork, registers, equipment, etc.

PART II - PRODUCTS

2.1 MATERIALS

A. All materials used shall be new as listed in subheadings and indicated on Drawings. Inspect all materials and immediately remove defective materials from the site.

B. All electrical materials shall bear the label of, or be listed by, the Underwriters' Laboratories (UL), unless the material is of a type for which label or listing service is not provided.

C. **Substitution:**

1. No substitute materials or equipment may be installed without the written approval of the Architect.

2. Use of substitute materials or equipment may require changes in associated materials and equipment. Contractor shall submit detailed Shop Drawings and installation instructions of substitute materials and equipment to Architect for approval. Such submittals shall address all changes required in other items.

3. All additional costs incurred by the substitution of material or equipment, or the installation thereof whether Architectural, Structural, Fire, Mechanical, Plumbing, or Electrical shall be borne by the Contractor who substitutes the materials or equipment in place of the items specified.

D. **Quality of Materials:** Fittings and equipment may be taken from stock but the Contractor will be required to submit manufacturer's certificates identifying the material and equipment furnished as conforming with these Specifications and such codes and standards as apply to the equipment specified. Any material on the site which cannot be identified by manufacturer's mark shall be removed from the site at Architect’s request.

2.2 SUBMITTALS

A. The review of submittals and approval thereof by the Architect does not relieve the Contractor from compliance with the requirements and intentions of the Drawings and Specifications to which the submittals pertain. The contractor acknowledges its responsibility to submit complete shop drawings and other required submittals. **Incomplete submittals will be returned to the contractor unreviewed.**
B. No item shall be installed without having been submitted and reviewed without comment. Should the Contractor install items that have not been submitted and reviewed, the work shall be changed at Contractor's own expense when so ordered by the Architect.

C. **Material List:** An itemized list of material and equipment which the Contractor proposes to use shall be submitted to the Architect with number of copies indicated and within time indicated.

D. **Product Data:**

1. Submit all required Drawings, product data, etc. at one time. Submittals shall be bound, tabbed, and properly indexed by Specification Section.

2. Each item shall be identified by manufacturer, brand, and trade name; model number, size, rating, and whatever other data is necessary to properly identify and verify the materials and equipment. The words "AS SPECIFIED" will not be considered sufficient information.

3. Each submittal shall bear the Contractor's stamp and mark indicating the Contractor has reviewed and approved the submittal.

4. Each submitted item shall refer to the Specification Section and paragraph in which the item is specified.

5. Accessories, controls, finish, etc. not required to be submitted or identified with the submitted equipment shall be furnished and installed as specified.

6. Submittals shall be all inclusive with all items requiring submittals being submitted at the same time; individual submittals will not be accepted.

7. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. If any materials or equipment are not ordered in time, additional charges made by equipment manufacturers to complete their equipment in time to meet construction schedule, together with any special handling charges, shall be borne by Contractor.

**PART III - EXECUTION**

3.1 **DRAWINGS**

A. The Drawings show the general arrangement and location of the ductwork and equipment. Work shall be installed in accordance with the Drawings, except for changes required by conflicts with the work of other trades. The Contractor shall provide for the support, expansion, and pitch of any rearranged ducts in conformance with the intent of the Drawings, Specifications, and codes.

B. Note that certain mechanical work is shown, wholly or in part, on Architectural Drawings.
C. Mechanical Drawings are diagrammatic and are intended to show the approximate location of equipment, ducts, and registers. Dimensions shown on Drawings shall take precedence over scaled dimensions on Drawings. All dimensions shall be verified in the field by the Contractor.

D. The exact location of apparatus, equipment, ducts, and registers shall be ascertained from the Architect or the Owner's representative in the field, and work shall be laid out accordingly. Should the Contractor fail to ascertain such locations the work shall be changed at Contractor's own expense when so ordered by the Architect. The Architect reserves the right to make minor changes in the location of ducts, registers, and equipment up to the time of installation without additional cost.

E. It is the intention of the Drawings and Specifications that, where certain mechanical items such as flexible connections, expansion joints, and other mechanical components are not shown, but where such items are required by the nature of the work, shall be furnished and installed.

F. The Mechanical Drawings and Specifications are intended to supplement each other. Any material or labor called for in one shall be furnished even though not specifically mentioned in the other.

G. Duct sizes shown are the minimum allowable and shall be increased in size if required by code or wherever necessary to meet unusual conditions.

3.2 RECORD DRAWINGS

A. Record Drawings shall be maintained at all times showing the exact location of equipment, ductwork, control panels, filters, dampers, etc. installed under all Sections. Obtain from the Architect, at cost, a complete set of prints. On these prints systematically and accurately keep a dimensional record of all work installed different from those shown on Drawings. Have these Drawings readily available for reference.

B. Record Set: When above information is complete and acceptable to the Architect transfer this information accurately to reproducible tracings, purchased at cost from the Architect for this purpose, and deliver to the Architect for final review.

C. Upon completion of the Architect's review of the Record Set the Contractor shall incorporate changes as noted on the record set. Deliver electronic PDF files with one (1) set of prints to the Architect. Deliver one (1) complete set of prints to building Owner within ninety (90) days of issuance of final occupancy report.

D. Inspector's Approval: Where a full-time inspector is employed by the Owner, the Record Drawing information shall be reviewed by the inspector during the course of construction and shall have the inspector's approval before submission to the Architect.
3.3 MECHANICAL ACCEPTANCE TESTS

A. Documentation on standard State of California Acceptance forms and inspection documents as listed on the project Certificate of Compliance shall be submitted to building department prior to issuance of building permit.

B. The required acceptance documents generated by the responsible person shall be signed by a designated licensed professional before submitting the required documents for final occupancy permit.

C. Complete all required Certificate of Compliance and Acceptance Tests as required for mechanical equipment shown in accordance with California Energy Code. Provide completed forms to owner representative.

3.4 DAMAGE

A. Repair any damage to the building, premises, and equipment occasioned by the work under this Section.

B. Repair all damage to any part of the building or premises caused by leaks or breaks in ducts, or malfunctions of equipment furnished or installed under this Section until the warranty period expiration date.

3.5 COMPLETE WORKING INSTALLATION

A. The Drawings and Specifications do not attempt to list every item that must be installed. When an item is necessary for the satisfactory operation of equipment, is required by the equipment manufacturer, or accepted as good practice, furnish without change in Contract cost.

3.6 STORAGE

A. Provide proper protection and storage of all items and tools required for this work.

3.7 QUALITY OF WORK

A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.

B. Systems shall be worked into a complete and integrated arrangement with like elements arranged to make a neat appearing and finished piece of work, with adequate head room and passageway free from obstructions. Such systems shall be installed by laborers experienced in the respective trades involved.

3.8 ELECTRICAL REQUIREMENTS - CONTROLS AND COORDINATION WITH ELECTRICAL CONTRACTOR

A. Mechanical Contractor shall coordinate with the Electrical Contractor on furnishing and installing of controls, motors, starters, etc. Coordinate means informing Electrical Contractor of items requiring electrical connection, providing copies of submittal data, installation data, scheduling work to insure efficient
progress, and promptly supplying those items to be installed by Electrical Contractor.

B. The specific requirements for electrical power and/or devices for each and every piece of mechanical equipment requiring electrical service, supplied and/or installed under this Contract, shall be coordinated and verified with the Mechanical Drawings, the Mechanical Sections of these Specifications, and with the manufacturers of the mechanical equipment supplied. This shall include the voltage, phase, ampacity; conduit requirements; exact location and type of disconnect, control, and connection required. Any changes from the Drawings and Specifications required as a result of this coordination shall be part of this Contract.

C. Electrical Contractor shall furnish and install the following for all mechanical equipment:

1. Conduit and wiring for line voltage power to the equipment.
2. Disconnect switches.

D. The work under this Section shall include furnishing and installing all controls on low and manual line voltage, including thermostats, auxiliary switches, relay wiring, interlock wiring; equipment control panels and transformers; and controls conduit unless specifically indicated as part of other work. Materials and methods of the control installation shall be in accordance with the Electrical Specifications.

E. The Mechanical Contractor shall review all wiring connections which have any influence on this equipment or work and verify that these connections are correct before permitting any equipment to be operated which is furnished, installed, or modified under this Contract.

3.9 ELECTRICAL REQUIREMENTS - MOTORS AND EQUIPMENT FURNISHED UNDER THIS SECTION

A. Motors and motor control equipment shall conform to the standards of the National Electrical Manufacturer's Association (NEMA). Motors and motor control equipment shall be as specified below. The work under this Section shall include:

1. Furnishing all motors, magnetic starters and automatic control devices for equipment furnished and installed by this Contractor.
2. Furnishing and installing line and/or low voltage interlock wiring shall be by the Mechanical Contractor. Installation of wire includes the connection of devices. All work shall be in accordance with the materials and methods specified in the Electrical Specifications.
3. Furnishing and installing completely wired equipment control panels with complete controls for automatic operation where indicated or when supplied with equipment.
4. Furnishing and installing all control and interlock wiring from equipment control panels to related remote devices, fans, motors, and controls.
5. Wire mounted on heat producing appliances shall be Type RHH or THHN (90°C).

6. Except as noted above, disconnect switches, power circuits from electrical panelboard to disconnect switch, starters, and motors shall be furnished and installed under the Electrical Specifications.

B. Motor starters for equipment exposed to rain shall be NEMA Type 3, weatherproof.

3.10 ELECTRICAL EQUIPMENT ROOM PRECAUTIONS

A. Ductwork or piping for mechanical systems shall not be installed in any switchgear room, transformer vault, telephone room or electric closet except as indicated. In any case, no ductwork or piping for mechanical systems shall be installed in the space equal to the width and depth of any electrical service equipment, switchboards, panel boards, or motor control centers and extending from the floor to a height of six feet above the equipment or to the structural ceiling, whichever is lower.

3.11 CUTTING AND REPAIRING

A. No cutting shall be done except with Architect's approval. Cutting of structural members or footings is prohibited without the prior written consent of the Architect and DSA, Structural Safety Division.

B. Where cutting of paving, walls, ceilings, etc. is necessary for the installation of the mechanical work, it shall be done under the direction of this Section. Damage caused by this cutting shall be repaired to match original and adjacent surfaces without additional expense to the Owner. Cutting of new construction shall be by the installing Contractor of that construction as directed by this Contractor.

3.12 BELT AND COUPLING GUARDS - FAN GUARDS

A. Provide guards for all belt-driven units, direct-connected units, and coupled units; and at chains, gears, shafts, couplings, keys, projecting set screws, and any other rotating or moving parts. Totally enclose all moving parts with guards. Guards shall be easily removable, center-split type, and constructed of welded angle iron and expanded metal. Rigidly support entire assembly with any necessary supplementary steel to prevent vibration. Prime coat entire assembly. Provide access openings for greasing, oiling, adjusting, checking of RPM, etc. All guards shall comply with applicable codes.

3.13 SLEEVES AND SEALING

A. Provide sleeves for all ductwork passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1" clearance all around between sleeve and ductwork. Sleeves are not required for holes through existing floors, walls, or partitions (in which case leave specified clearance between hole and ductwork). When ductwork is insulated, insulation shall pass continuously through sleeve with 1" clearance between insulation and sleeve or hole in existing construction.
B. Sleeves shall permit free thermal expansion of duct without binding or contact with structure.

C. Special sleeves detailed on Drawings shall take precedence over this Section.

D. Duct Sleeves: Should be as follows unless otherwise indicated. Sleeves specified or indicated at fire dampered penetrations shall take precedence over this article.
   1. Plaster or Drywall: 18 gauge galvanized steel

E. Sealing of Sleeves or Holes:
   1. Fire Rated Wall and Floor Sleeves or Holes (Insulated Pipe): Caulk space between pipe insulation and sleeve with 3-M brand Fire Barrier Sealant CP-25WB+ or Dow/Corning #3-6548 Silicon RTV Foam, with thickness appropriate for floor or wall fire rating. Seal top of floor sleeve with Tremco Dymeric Sealant.
   2. All other sleeves or holes: Sleeves shall be packed with safing insulation and sealed with Tremco Dymeric Sealant.
   3. Trim Plates: Provide minimum 1" trim plates at visible sides of openings on all exposed ducts passing through floors, walls, partitions, plaster furring, etc. unless otherwise specified or indicated. Plates shall be prime coated.

3.14 SUPPORTS

A. All equipment, plenums, registers, and ductwork shall be mounted on, or suspended from, foundations and supports as specified and indicated, and seismically braced to structure.

B. Vibration isolation and seismic restraints for vibration isolated equipment per Title 24.

C. All registers, ducts, and equipment shall be securely anchored to building structure as required by the Specifications, SMACNA’s "Guidelines for Seismic Restraints of Mechanical Systems", Title 24, and the California Building Code.

D. Earthquake restraints shall be capable of resisting 100% gravity lateral loads or as required by Title 24.

E. Supplemental Supports: Provide supplemental supports to span building structural elements as necessary for equipment foundations and supports. Provide Shop Drawings to Mechanical Engineer and Architect for approval prior to installation.

3.15 INSTALLATION AND ALIGNMENT

A. Fan and motor pulleys shall be carefully aligned and belt tension properly adjusted by manufacturer's representative or qualified mechanic in accordance with manufacturer's instructions.
3.16 VIBRATION CONTROL

A. **Mechanical Balance**: When equipment is installed and in normal operation, fans, pumps, motors, and drives shall be within the following maximum limits:
   1. **600 RPM and Less**:
      Three mils displacement, peak to peak.
   2. **Over 600 RPM**:
      0.10" per second.

B. **Pulley Run-Out**: When equipment is installed and in normal operation, pulley run-out in radial and axial directions not to exceed 0.001".

C. **Field Tests**: If requested, test equipment to determine compliance with specified requirements. Measure vibration displacement and velocity in vertical direction relative to floor. Make measurements on bearing housings (not end caps) or other heavy structural element directly connected to bearing housing at each end of equipment.

D. **Field Balancing**: Balance and retest equipment as required for compliance with specified requirements.

3.17 ACCESSIBILITY

A. **General**: Damper operators, filters, and indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.

B. **Panels**: No dampers, controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether or not shown on Drawings.

C. **Access Panels in Walls or Ceilings**:
   1. Provide access panels in walls or ceilings where indicated and where required to provide access to dampers, and other appurtenances. Panels shall be style as selected by Architect and as directed by wall or ceiling construction. Panel size shall be 24" x 24" unless indicated otherwise. Panels in acoustical barriers shall have same transmission loss as barrier. Panels in rated construction shall have same rating as construction in which installed.
   2. Door panels shall be no lighter than 14 gauge steel. Doors shall be equipped with concealed spring hinges and flush, screwdriver operated locks, except that key operated locks shall be used for all access doors in walls where door is within 6'-0" of floor. Locks for all key operated doors shall be keyed alike.

3.18 TESTING

A. Test all ductwork, equipment, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be
witnessed. Protect all personnel and equipment during testing. Where Specifications do not cover specific points or methods, conform to manufacturer's specifications.

3.19 DEMOLITION

A. Removal, storage, or disposal of existing equipment and related piping, ductwork, etc. shall be under the direction of the Architect.

B. Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.

C. There is a possibility that materials containing asbestos may be encountered. Advise the Owner in a timely manner of its presence and in accordance with EPA regulations.

3.20 DUCTWORK OPENINGS

A. Locating and sizing of all openings for ductwork through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.21 EQUIPMENT

A. All equipment shall be accurately set and leveled. Supports shall be neatly placed and properly fastened. All equipment shall be fastened in place with bolts.

B. Keep all openings closed with plugs or caps to prevent entrance of foreign matter. Protect all ductwork, registers, and equipment against dirt, water, chemical, or mechanical damage both before and after installation. Any equipment or apparatus damaged prior to final acceptance shall be restored to original condition or replaced at the Architect discretion and at no additional cost to the Owner.

C. Start-Up: Equipment shall be adjusted, lubricated, aligned, etc. prior to start-up. Inspect each piece of equipment prior to start-up. Start each piece of equipment in accordance with manufacturer's directions and warranty requirements.

D. Finish: Protect all equipment and materials until in use. Any visible rust or corrosion shall be removed as directed prior to installation. All damaged factory painted finishes shall be cleaned and painted with manufacturer provided paint.

3.22 MANUFACTURER'S DIRECTIONS

A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents. Where manufacturer's instructions differ from those indicated or specified, they shall be brought to Architect attention for resolution prior to equipment ordering and installation.

B. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.
3.23 SEISMIC RESTRAINTS
A. **General:** All work, materials and methods used shall conform to the Drawings and Specifications. The following notes and SMACNA "Guidelines for Seismic Restraints of Mechanical Systems" shall be followed when specific details are not shown on the Drawings. Anchorage of equipment for which specific details are not shown on the Drawings shall be adequate to resist the forces based on the required "CP" factor. Such anchorage shall be approved by the Architect, Structural Engineer, and the Division of the State Architect (DSA) Field Engineer.

3.24 CLEAN-UP
A. During the course of work under this Section, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean and in a condition acceptable to the Architect.

B. Clean all work installed under this Contract to satisfaction of Owner and submit documentation that each system has been cleaned and results witnessed by the Architect representative.

C. Remove debris and trash from ductwork, fan units, and all air handling equipment. Vacuum clean fan housing, coils, and ducts in vicinity of openings before grilles and registers are installed. Replace construction filters with new filters prior to project completion.

3.25 ENGRAVED NAMEPLATES
A. Furnish and install engraved brass nameplates with 1/4" minimum lettering at panel mounted control devices, manual control stations, power disconnects, motor starters and pieces of equipment.

3.26 FINAL INSPECTION
A. The Contractor shall furnish the Architect with certificates of final inspection and approval from the inspection authorities having jurisdiction.

3.27 GUARANTEE
A. The Contractor shall guarantee the quality of all work and the quality of equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.

3.28 SITE VISITS BY ENGINEER
A. Engineer's responsibility is limited to normal construction support services only, consisting of office consultation, site visits, and reports to the Architect at appropriate stages of construction such as rough-in, pre-final, and final. All costs incurred by the Engineer for additional site visits or office work required to complete the project as the result of incomplete coordination or supervision by
the Contractor or the Mechanical Sub-Contractor shall be paid for by the Contractor.

3.29 OPERATING AND MAINTENANCE MANUALS

A. Three (3) complete sets of bound instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment shall be furnished to the Owner within ninety (90) days of issuance of final occupancy permit. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers, "OPERATING AND MAINTENANCE INSTRUCTIONS", the name and location of the building, the name of the Contractor, and the Contract number. Flysheets shall be placed before instructions covering each subject. The instruction sheets shall be approximately 8 1/2" x 11" with large sheets of Drawings folded in. The instructions shall include, but not be limited to, the following:

1. Approved wiring and control diagrams.
2. A detailed control sequence describing start-up operation and shut-down with reference to control names and numbers.
3. Operating and maintenance instructions for each piece of equipment including lubrication instructions. Include information on frequency of lubrication, filter change, belt adjustment, cleaning, adjusting, etc.
4. Manufacturer's bulletins, cuts, and descriptive data.
5. Parts list and recommended spare parts including name and address of source of supply.

B. Field Instructions: Upon completion of the work and at a time designated by the Owner the services of one or more competent Contractors shall be provided by the Contractor to instruct a representative of the Owner in the operation and maintenance of the systems. These field instructions shall cover all the items contained in the bound instructions and shall be of a sufficient length and detailed nature, in the Contractor's judgment, to insure safe and efficient operation.

END OF SECTION 23 00 00
SECTION 23 05 00
MECHANICAL

PART 1 - GENERAL

1.1 GENERAL

A. The General Conditions, any Supplementary Conditions, Section 23 00 00, Mechanical General, and Division 1 are hereby a part of this Section as fully as if repeated herein.

1.2 SCOPE

A. Provide labor, material, equipment, and services to furnish and install complete heating, ventilating and air conditioning systems which shall include, but not necessarily be limited to equipment, ductwork, and temperature controls.

1.3 SUBMITTALS

A. Submit for review the required copies of a complete list of materials proposed for use, accompanied by manufacturer’s data sheets giving sizes, capacities, etc. See General Conditions for requirements. Such list shall include the following:

1. VRF fan coils and heat pump.
2. Exhaust fans.
3. Ductwork.
4. Filters.
5. Diffusers, registers, and grilles.
7. Mechanical supports.
8. Balancing agency and protocol.
9. HVAC control system.
10. Acoustic performance.

B. No substitute materials or equipment may be installed without the written approval of the Architect.
C. All additional costs incurred by the substitution of material or equipment, or the installation thereof, whether architectural, structural, mechanical, electrical, or plumbing, shall be borne by the Contractor.

D. For equipment specifically fabricated for this project, Shop Drawings and detailed description shall be submitted.

E. Quality of Shop Drawings and reproduced prints shall be equal to the Architectural Drawings. Prints shall be black-line or blue-line type on white background. Furnish prints of each diagram and schedule sheet with maintenance manuals.

1.4 FINISH AND PAINTING

A. See Division 09.

1.5 DEFINITIONS FOR "EXPOSED" AND "CONCEALED"

A. Concealed: "Concealed" means hidden from sight in normally inaccessible areas such as trenches, chases, furred in spaces, areas above drop ceilings, crawl spaces, attic spaces, or pipe shafts.

B. Exposed: "Exposed" means not "concealed", as defined previously. Exceptions to these definitions are specified. Service tunnels, mechanical equipment rooms, and storage areas; unfinished rooms are considered exposed.

1.6 SEISMIC

A. Seismic restraints for all equipment and ductwork shall be provided and installed by the Contractor using the details and schedules contained in the publication, "Guidelines for Seismic Restraints of Mechanical Systems", by SMACNA of Los Angeles. All seismic restraints provided using the schedules in this manual shall be considered to be for "essential buildings" or "life safety equipment". Equipment requiring vibration isolators shall be provided with seismic type vibration isolators or restraining devices as shown on Drawings for lateral loads. See Section 23 00 00, Mechanical General, for additional requirements.

PART II - PRODUCTS

2.1 HVAC EQUIPMENT

A. See Schedules on Drawings for equipment data. Furnish and install all equipment in accordance with Drawings, manufacturer’s recommendation and all applicable codes.

2.2 FILTERS

A. Filter(s) shall be disposable type, Class 2 UL listed.
B. Filter(s) shall be minimum MERV 13 based on ASHRAE Standard 52.2 test method. Filters for cassette fan coils shall be MERV 8.

2.3 DUCTWORK

A. **Duct Construction**: Construction of ductwork shall be as follows:

1. Galvanized sheetmetal of thickness recommended in the latest edition of the SMACNA HVAC Duct Construction Standards, for 2" w.g., 2500 FPM maximum velocity, except no ducts shall be less than 24 gauge. Fabricate in accordance with SMACNA Standards except where otherwise specified or indicated.

2. **Rectangular Ductwork**: Groove and Pittsburgh lock seams and slip joints shall be used for all low pressure rectangular ducts. Contractor may use manufactured duct joint systems by Ductmate Industries, Ductmate "35" System for rectangular ducts, and Ductmate "Spiralmate" for round spiral sheetmetal duct. Provide duct joint systems where indicated on Drawings. Joint systems may be used on concealed ductwork at Contractor’s option. Install per manufacturer's recommendations.

2.4 DUCT INSULATION AND LINING

A. Supply and return ductwork in directly conditioned space.

1. Acoustic duct liner shall be Owens-Corning QuietR, AcousticR duct liner, type 200, R-4.3, 1” thick, Johns-Manville Linacoustic RC duct liner, 4-4.2, 1” thick or approved equal, average thermal conductivity of 0.23 per inch of thickness at 75°F mean temperature.

B. Supply and return ductwork in exterior and/or unconditioned space.

1. Acoustic duct liner shall be Owens-Corning QuietR AcousticR acoustic duct liner board, R-8.0, 2” thick, unless otherwise indicated, average thermal conductivity of .23 per inch of thickness at 75°F mean temperature.

C. All duct insulation shall comply with Section 124, requirements for air distribution system ducts and plenums, 2008 Building Energy Efficiency Standards, California Code of Regulations, Title 24, Part 6.

2.5 DAMPERS AND SHEETMETAL SPECIALTIES

A. Volume dampers shall be single blade dampers, job or factory fabricated of galvanized steel, two gauges heavier than duct and no longer than 12” x 48” reinforced or crimped for rigidity with pivot rod extending through duct. Positioning device shall be locking lever and quadrant.
B. Damper gravity type shall be multi-blade air damper to open on 0.06" w.g. pressure differences and close by gravity. Aluminum 16 gauge frame, 0.023" blades of flat or elliptical shape. Tie-bar to connect blade for parallel operation. Resilient gasket for air seal and quiet operation. Blade pivots shall be in nylon bushings. Provide counter-balance. Fabric blade damper acceptable alternative if UL listed material.

C. Flexible duct connectors at equipment shall be UL listed and provided with 24 gauge galvanized sheetmetal sun screen where exposed to weather.

D. Volume extractors shall efficiently divert, equalize and control air flow from main ducts into take-off and remain aligned. Extractor shall have a series of radius vanes attached to pivoting frame and bracket, gang operated, with all vanes synchronized to move as a unit. Vanes shall be capable of being set from open (45°) to closed position. Extractors installed in duct take-offs 12" and smaller shall have maximum of 2" spacing for vanes. Blades shall be two gauges heavier than duct.

E. Metal gauges, joints, bracings, duct supports and turning vanes shall conform to SMACNA HVAC Duct Construction Standards as minimum standard, and as specified and/or shown.

F. Sheetmetal ductwork access doors shall be large enough for maintenance and equipment. Doors shall be factory fabricated with latches that can be easily opened without tools, hinges, and perimeter seals. Where insulation is required, doors shall have insulation as an integral part. Construction and air tightness must be suitable for duct pressure class.

2.6 LOUVERS

A. Louvers shall be galvanized steel, all welded construction, stationary type with integral water gutter on the blades and downspouts in jambs. Louvers shall be 4” deep in direction of air flow.

B. Pressure drop shall not exceed 0.15" w.c.. Louvers shall be certified to be tested and rated in accordance with AMCA standard 500 and shall bear an AMCA seal.

2.7 REFRIGERANT PIPING

A. Refrigerant Pipe

1. Copper tubing may be soft annealed where bending is required and shall be hard drawn where no bending is required. Soft annealed copper tubing shall not be used in sizes larger than 1/2" and only in equipment enclosures.

2. Copper tubing shall be type ACR with dry nitrogen holding charge and plugged ends to be removed at time of installation.
3. Fittings for flare joints shall be standard SAE forged brass flare type with short shank flare units.

4. Fittings for brazed joints shall be wrought copper or forged brass sweat fittings.

5. Cast sweat-type fittings will not be allowed for brazed joints.

B. Refrigerant Pipe Insulation

1. Foamed Plastic Pipe Insulation - Indoor Use: Halstead Products F/R Insultube, Schuller Armaflex, average thermal conductivity at 70°F mean temperature, 0.26 per inch of thickness. Cover fittings and valves with miter-cut pieces. Seal longitudinal and butt joints with 520 adhesive, 3/4" thickness.

2. Continuous Molded Urethane Pipe Insulation - Outdoor Use: Owens-Corning with factory applied all-service jacket, average thermal conductivity at 100°F, 0.16 per inch of thickness per ASTM C335-69. Seal longitudinal joints with outward clinching staples 3" on center. Apply vapor barrier mastic on all circumferential and longitudinal seams. Apply factory supplied butt strips to circumferential joints. Cover with .016 thickness aluminum jacket.

C. Refrigerant Piping Supports

1. Super Strut C-727 UL and FM approved, solid rods and rod clips.

2. Supports and Beam Clamps: Super Strut C-769.

3. Trapeze Hangers: Super Strut A-120 channel with pipe clamps and guides as required (include type to be used in submittal).


5. Offset Pipe Clamps: Super Strut or approved equal.


7. Sway Bracing: Where hanger rods on horizontal runs of 2-1/2" pipe and large rare 12" in length or longer, there shall be one 3/16" x 1-1/4" steel angle brace (Super Strut A-1200 channel acceptable) bolted to every other pipe hanger clamp and anchored to the wall or ceiling. Stays to ceiling or roof shall rise at a 45 degree angle and be anchored with 3/16" bolts for steel construction. Successive braces shall be installed on opposite sides of the pipe run.

8. Plumber's tape or sheet metal straps shall not be used for hanging or supporting pipes.
9. Space hangers and supports for horizontal copper tubing according to the following schedule:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Maximum Spacing in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot; and 1&quot;</td>
<td>6</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>7</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>8</td>
</tr>
</tbody>
</table>

2.8 REGISTERS AND DIFFUSERS

A. Registers and diffusers shall be as indicated on Drawings. Provide integral opposed blade dampers where indicated. Provide integral combination volume/fire damper at rated ceilings. Registers shall have adjustable air pattern for setting in field to match field conditions. Redirect air pattern when required or directed. Provide margins, leveling clips, plaster ground or frame as required for ceiling system in which diffuser or register is installed.

2.9 HVAC CONTROL SYSTEM

A. A complete system shall be provided. System shall include components required to provide temperature and ventilation control for each zone.

B. Provide required sequence of control (see Drawings).

C. Furnish and install thermostats where indicated. Coordinate exact locations with Architect.

D. Control system shall be complete and fully operational prior to system balancing.

E. **Wiring:** Run in conduit and in accordance with Division 26 of these Specifications. All low voltage wiring required for HVAC controls shall be provided hereunder. See Section 23 00 00, *Mechanical General*, and Division 26. All wiring shall be color coded and tagged in accordance with approved control diagrams.

F. **Local Control Panels:** Install where indicated with all control components associated with the system(s) installed therein.

1. Panel shall be flush mounted NEMA 1 enclosed type, constructed of steel with locking hinged door. One key shall be provided to Owner for each panel.

2. Panel shall be pre-wired to numbered terminals for external connection. Where voltage exceeds 100 V, terminal strips and electrical items with exposed terminals shall be grouped in separate area of panel for items where voltage is less than 100 V.
Provide insulating barriers for safety for items inside panel and for all items flush mounted in face of panel door.

3. System time clock(s) shall be installed within control panel.

G. Instrumentation and Components:

1. Scale and indicator ranges for all instruments shall be selected to cover possible variations of measured medium and with normal value in approximate center of span.

2. Room Thermostats: All room thermostats shall have adjustable setpoints and setpoint indicator. Mount thermostats 4'-0" above floor, or as indicated. Thermostats shall have throttling range of sensitivity or other adjustment feature as required for each application to maintain ±2°F or as otherwise specified. Thermostats shall be as specified in sequence, or as required for the application.

2.10 ACoustic Performance

A. It is the intent of this Specification that noise levels due to air conditioning and/or ventilating equipment, ducts, grilles, registers, diffusers, dampers, boxes, etc. will permit attaining sound pressure in all eight octave bands in occupied spaces conforming to the following NC (noise criteria) curves, as explained in the latest issue of the ASHRAE Handbook and Product Directory Systems:

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Preferred</th>
<th>Alternate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conference Rooms</td>
<td>RC 25-30(N)</td>
<td>NC 25-30</td>
</tr>
<tr>
<td>Open-Plan Areas</td>
<td>RC 35-40(N)</td>
<td>NC 35-40</td>
</tr>
</tbody>
</table>

PART III - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Equipment shall be installed level, on curbs or supports as required or indicated on Drawings and in accordance with manufacturer’s recommendations.

B. Equipment shall be installed in locations shown and as complete assemblies with service clearance required for access and maintenance.
3.2 DUCTWORK - INSTALLATION

A. All ductwork shall be in accordance with the applicable SMACNA manual, unless otherwise specified, airtight and supported as recommended. Ductwork shall run concealed unless otherwise noted.

B. Erect all ductwork to dimensions indicated, straight and smooth on the inside with neatly finished joints lapped in direction of air travel. Properly brace and reinforce all ducts with steel angles or other members. All ductwork shall be of galvanized steel unless otherwise specified or indicated. Fabricate changes in direction, both horizontal and vertical, to permit easy air flow.

C. Duct that has been crushed or damaged shall be replaced.

D. Install ductwork to clear all obstructions, preserve headroom, and keep openings clear.

E. Should it be found impractical to install any duct of the exact size given, a duct of a different shape but having the same air resistance shall be installed. These alternate duct sizes to be approved by the Engineer prior to installation. Duct sizes given are inside dimensions inside the linings.

F. All elbows 45° or greater shall be full elbows (centerline radius equal to duct width) or shall have turning vanes.

G. Ends of ducts shall turn over 3/4" for airtight connections between ducts and grilles. The ducts and grilles shall have separate sets of screws. Register frames and ends of ducts shall be properly placed before finishing is begun.

H. Provide volume extractors or volume dampers capable of adjustments and of being locked into position in take-offs. Provide suitable access through insulation for adjustment of extractors and dampers.

I. All ducts shall be supported per SMACNA HVAC Duct Construction Standards for sheetmetal ducts and per SMACNA Seismic brace ductwork as indicated and per SMACNA manual.

J. Vertical ducts shall be supported by extending bracing angles bolted to walls, columns, or other construction.

K. Fabricate compression type supports from cross-braced metal angles not smaller than that required for duct bracing.

L. Duct Sealing:

1. Ducts exposed to weather shall be completely weatherproof with outdoor vapor barrier mastic over tape at all joints and seams.

2. Seal joints and seams of interior ductwork air tight.
3. No "grey" or fabric duct tape shall be used. Metal duct sealing shall be "Aerobol", "hardcast", or SMACNA approved foil-backed pressure sensitive tape, except where otherwise indicated or specified.

4. All duct sealing shall comply with section 124, requirements for air distribution system ducts and plenums, 2008 building energy efficiency standards, California Code of Regulations, Title 24, part G.

3.3 DUCT INSULATION AND LINING - INSTALLATION

A. All concealed ductwork shall be insulated with fiberglass ductwrap unless otherwise specified.

B. Any exposed ductwork in conditioned space shall have acoustic duct liner. Outside air and exhaust ducts shall not be insulated.

C. All exposed ducts for conditioned air in non-conditioned space or outdoors shall be lined with acoustic duct liner.

D. Rectangular ductwork may be lined with acoustic liner in lieu of exterior ductwrap. Provide acoustic lining where indicated on Drawings.

E. Duct lining shall be installed according to manufacturer's application Specification with stick clips and adhesive and per the SMACNA Duct Liner Manual.

1. Mechanical fasteners shall be flush with liner surface. All exposed edges and leading edges of all cross-joints of the liner shall be heavily coated with approved fire resistant adhesive. Duct liner shall be cut to assure snug closing corner joints; the black surface of the liner shall face the air stream; transverse joints shall be neatly butted; and any damaged areas shall be coated with a fire resistant approved adhesive.

3.4 FLEXIBLE CONNECTORS - INSTALLATION

A. Flexible connections shall be installed on inlet and outlet duct connections of fans, ventilating units and air conditioning units. Fabric shall be of weight and strength for service required, properly fitted to render connection air tight. Fabric of sufficient width to provide minimum space of 4" between connected items.

3.5 REFRIGERANT PIPE INSTALLATION

A. Install piping in accordance with good practice, as specified below and as indicated on the Drawings.

B. Refrigerant pipe installation shall be in conformance with ANSI/ASHRAE 15 (latest version) and ANSI B31.5.
C. Pitch: All refrigerant piping shall be installed with sufficient pitch in proper direction to insure adequate oil return to compressors. Provide suction traps at base of all suction risers.

D. General: Pipe shall be cut accurately to measurements established at the job site and worked into place without springing or forcing, allowing for proper head room.

E. Supports shall be attached only to structural framing members.

F. Pipes shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints or hangers.

G. Changes in direction shall be made with fittings.

H. Open ends of pipelines and equipment shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system.

I. Joints in copper tubing shall be cut square, ends shall be reamed and all filings and dust wiped from interior of pipe. Joints in refrigerant lines shall be brazed with "Silphos" solder with a minimum melting point of 800°F. A continuous flow of dry nitrogen shall be bled through tubing while being heated or brazed.

3.6 REFRIGERANT PIPE INSULATION INSTALLATION

A. Materials shall be installed in accordance with the recommendations of the manufacturer. Insulation at joint shall not be applied until tests specified in other Sections of these Specifications are completed.

B. Tubing shall be insulated by slipping the tubular insulation section over the pipe prior to joining. Joints shall have the insulation slipped over or slit and installed after testing. Seams and butt joints shall be sealed with contact adhesive recommended by manufacturer.

3.7 FIELD TESTS AND INSPECTIONS

A. The Contractor is responsible for the administration and direction of tests. Furnish instruments, equipment, connective devices and personnel for the tests. Notify the Architect seven (7) days before inspection or testing is scheduled.

B. The Mechanical Contractor shall procure the services of an independent air balance and testing agency, approved by the Architect, which specializes in the balancing and testing of heating and ventilating systems to balance, adjust, and test air moving equipment, air distribution, and exhausting systems as herein specified. All work by this agency shall be done under direct supervision of a qualified test and balance engineer employed by them. Engineer/Agency shall be NEBB and/or AABC.
certified. All instruments used by this agency shall be accurately calibrated and maintained in good working order. If requested, the tests shall be conducted in the presence of the Architect and/or his/her representative or the Owner's representative.

C. The Contractor shall submit, within 15 days after receipt of Contract, seven (7) copies of submittal data for testing and balancing of the heating and ventilating systems.

D. The Balancing Contractor shall submit a balancing protocol to the Architect for approval. The protocol will detail testing methods and procedures, indicate sequence of testing, specify equipment to be used with model numbers, serial numbers, and calibration dates. A general procedure will not be accepted; procedure must be specific and address the requirements of the project.

E. The Mechanical Contractor shall award the test and balance contract to the approved agency upon receipt of his/her Contract to allow the balancing agency to schedule this work in cooperation with trades involved and comply with the completion date.

F. Test and balance agency shall include in its work allowance for the project a one year warranty, during which time the Owner, at his/her discretion, may request a recheck or resetting of any outlet, supply air fan or exhaust fan as listed in the test report. The agency shall provide technical personnel to assist the Architect in any tests he may require during this period of time.

NOTE: AFTER THE FINAL AIR BALANCE OF THE SYSTEM, REBALANCING MAY BE REQUIRED TO OBTAIN UNIFORM TEMPERATURE AS REQUIRED BY ACTUAL OCCUPANCY.

G. Air balance performance and testing shall not begin until system has been completed and is in full working order. The Contractor shall put all heating, ventilating and air conditioning systems, and other equipment, in full operation and shall continue the operation of same during each working day of testing and balancing.

3.8 SPECIAL REQUIREMENTS

A. The Balance Contractor shall review the project Drawings and become thoroughly familiar with the job site when the construction is in the early stages. During this review, all items discovered adversely affecting balancing or system performance shall be called to the attention of the Architect. Prior to any closing in of ductwork, verify that all fittings, dampers, control devices and test devices are properly located and installed. Submit report of this field visit to Contractor within 24 hr for review and comment by the Architect.

B. Examine each air distribution system to see that it is free from obstructions. Determine that all dampers and registers are in the required
setting; that equipment is lubricated; and that the required filters are clean and functioning. Request that the Installing Contractor perform any adjustments necessary for proper functioning of the system.

C. The Balance Contractor shall use test instruments that have been calibrated within a time period recommended by the manufacturer and have been checked for accuracy prior to the start of the testing, adjusting and balancing activity.

D. Balance Contractor shall become familiar with and comply with the provisions of all national and local codes, ordinances and safety acts that affect the work.

E. All diffusers, grilles and registers shall be adjusted to minimize drafts in all areas. Air distribution patterns shall be adjusted as per the Drawings.

F. As a part of the work of this Contract, the Mechanical Contractor shall make any changes in the pulleys, belts and dampers, or the addition of dampers required for correct balance as recommended by the Balancing Agency, at no additional cost to the Owner.

3.9 PERFORMANCE TESTING AND BALANCING

A. Balancing and Testing of Air Systems: Adjust, balance and test air systems to achieve and confirm compliance with Drawings and Specifications. Prepare complete report of final test results and submit seven (7) copies to Contractor for forwarding to Architect for review and approval. Prior to submitting it to the Architect, the Mechanical Contractor shall stamp and sign the cover page indicating he has reviewed the report and concurs with the findings. The report shall also be signed by the supervising test and balance engineer.

B. Allowance shall be made for air filter resistance at the time of tests. The main air supplies shall be set with filter resistance midway between clean and dirty filters.

3.10 TESTING PROCEDURE

A. The air balance agency shall perform the following tests and balance system in accordance with the following requirements:

1. Test and adjust fan RPM to design requirement.

2. Test and record motor amp draw and voltage; record and report all nameplate data for each fan.

3. Make pitot tube traverse of main ducts and obtain design CFM at fans.

4. Test and record each system’s static pressures supply and return.
5. Test and adjust each system within 10% of total design air CFM. Report final air quantities.

6. Test and adjust system for design minimum CFM outside air, exhaust CFM. Report final air quantities.

7. Test and record entering air temperature in heating and cooling modes.

8. Test and record leaving air temperature in heating and cooling modes.

9. Test and adjust each diffuser, grille, and register to within 10% of design requirements.

10. Each grille, diffuser and register shall be identified as to location or area served.

11. Size, type, and manufacturer of diffusers, grilles, registers, and all tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations.

12. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM, and test resultant CFM after adjustment.

13. In cooperation with the Control Contractor, adjust automatically operated dampers to operate as specified, indicated, and required. Testing agency shall check all controls for proper calibration and list all controls requiring adjustments by control installers.

14. Record setting of zone thermostats, record temperatures of each room after balancing is completed and indicate time and date of reading. Provide records in both heating and cooling modes.

B. **Sound Level Tests:** Upon completion of testing and balancing of air systems, conduct sound level tests of conditioned spaces. Use approved calibrated octave band analyzer and record sound levels in db for each of the eight (8) octave bands. Record the following data for each room and system.

1. Background sound level (systems off).

2. Sound level heating (systems operating).

3. Sound level cooling (systems operating).

4. Record data on outdoor sound levels at HVAC equipment locations as directed by the Architect.
C. **NC Chart**: Provide dB to NC conversion chart covering 31.5 through 8000 Hz octave bands.

D. **Test Locations**: Take sound level reading at location 6'-0" from face of outlet on a line at 45° with face of outlet.

E. **Remedial Action**: If sound level at any observation point exceeds specified levels, the Contractor shall take remedial action as directed by the Architect. Additions of sound traps, insulation or dampers shall be made by the Air Conditioning Contractor under the direction of the sound balancing agency and at no additional cost to the Owner.

3.11 ACCEPTANCE REQUIREMENTS

A. Equipment and systems requiring certification for Code Compliance shall have Certificate of Acceptance completed and submitted to enforcement agency. See drawings for equipment and systems requiring acceptance certification.

3.12 INSTRUCTION BOOK - MAINTENANCE MANUALS

A. The Contractor shall provide the Owner with three (3) copies of complete written instructions in the operation of the various systems. The instructions shall be bound in booklet form and shall include all pertinent operation and maintenance information on the equipment, with names of local suppliers and agents. The Contractor shall also instruct the Owner or his/her representatives in the operation of the system. The instructions shall reference all equipment numbers. See Section 23 00 00, *Mechanical General* for additional requirements.

END OF SECTION 23 05 00
SECTION 23 09 00
DIRECT DIGITAL CONTROLS FOR MECHANICAL

PART 1  GENERAL

1.1 Summary

A. Furnish and install a digital Building Automation System (BAS) as specified herein.

1.2 Coordination with other Trades

A. Consult all 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. This section is provided to assist Contractor in coordination of work scope but shall not be construed to limit Contractor’s scope of work encompassed by the contract documents.

1.3 Integration with Existing System

A. Include all services required to integrate this building into existing BAS for a fully operational system.

B. The existing BAS is Andover.

C. Procedure

1. Provide all controls work within the building as indicated on Drawings and in this Section.

2. Develop all building level control system databases and control programming using existing standards and standard programming.

3. Install building databases and control programming on a temporary portable operator’s terminal provided by the Contractor. The POT shall be used for start-up and testing. The POT shall remain the property of the Contractor after final completion of the project.

4. Once the building BAS has been fully accepted by the College, merge database and programming with those existing on the Control System Servers. Confirm that the merge was successful by sample testing points and sequences, and approve final installation in writing.

5. Integrate graphic screens into the Central Plant graphics including adding appropriate hyperlinks so that the system operates as one integrated system.
6. Provide high level password for College operator access to the system only at this point; College will not have access to the system prior to system acceptance and integration.

1.4 Contractor Proposals

A. If a contractor finds that a certain requirement is unduly difficult or expensive to meet, contact the Engineer prior to bid due date and an addendum modifying the requirement will be considered.

B. Where requirements are unclear, the contractor shall clarify the requirements with the Engineer before the bid due date. Where requirements continue to be unclear, the contractor’s proposal must accurately describe what is included and excluded.

C. By submitting a proposal, contractor guarantees that their proposal is in full compliance with these specifications except as specifically excluded in their proposal.

1.5 Reference Standards

A. Nothing in Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules, and regulations. When Contract Documents differ from requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.

B. The latest published or effective editions, including approved addenda or amendments, of the following codes and standard shall apply to the BAS design and installation as applicable.

C. State, Local, and City Codes

1. CBC – California Building Code
2. CMC – California Mechanical Code
3. CEC – California Electrical Code
4. Local City and County Codes

D. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)


E. Electronics Industries Alliance
1. EIA-232 – Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.


4. EIA-472 – General and Sectional Specifications for Fiber Optic Cable.

5. EIA-475 – Generic and Sectional Specifications for Fiber Optic Connectors and all Sectional Specifications.


7. EIA-590 – Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant and all Sectional Specifications.

F. Underwriters Laboratories


G. National Electrical Manufacturers Association

1. NEMA 250 – Enclosure for Electrical Equipment.

H. Institute of Electrical and Electronics Engineers (IEEE)


2. IEEE 802.3 – CSMA/CD (Ethernet – Based) LAN.

3. IEEE 802.4 – Token Bus Working Group (ARCNET – Based) LAN.

1.6 Definitions

A. Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAC</td>
<td>Advanced Application Controller</td>
</tr>
<tr>
<td>AH</td>
<td>Air Handler</td>
</tr>
<tr>
<td>AHU</td>
<td>Air Handling Unit</td>
</tr>
<tr>
<td>AI</td>
<td>Analog Input</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>AO</td>
<td>Analog Output</td>
</tr>
<tr>
<td>ASC</td>
<td>Application Specific Controllers</td>
</tr>
<tr>
<td>ASCII</td>
<td>American Standard Code for Information Interchange</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigeration and Air Conditioning Engineers</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>A-to-D</td>
<td>Analog-to-Digital</td>
</tr>
<tr>
<td>BACnet</td>
<td>Data Communications Protocol for Building Automation and Control Systems</td>
</tr>
<tr>
<td>BC</td>
<td>Building Controller</td>
</tr>
<tr>
<td>BIBB</td>
<td>BACnet Interoperability Building Blocks</td>
</tr>
<tr>
<td>BTL</td>
<td>BACnet Testing Laboratory</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer Aided Drafting</td>
</tr>
<tr>
<td>COV</td>
<td>Change of Value</td>
</tr>
<tr>
<td>CSS</td>
<td>Control Systems Server</td>
</tr>
<tr>
<td>CU</td>
<td>Controller or Control Unit</td>
</tr>
<tr>
<td>CV</td>
<td>Constant Volume</td>
</tr>
<tr>
<td>DBMS</td>
<td>Database Management System</td>
</tr>
<tr>
<td>DDC</td>
<td>Direct Digital Control</td>
</tr>
<tr>
<td>DI</td>
<td>Digital Input</td>
</tr>
<tr>
<td>DO</td>
<td>Digital Output</td>
</tr>
<tr>
<td>D-to-A</td>
<td>Digital-to-Analog</td>
</tr>
<tr>
<td>BAS</td>
<td>Building Automation System</td>
</tr>
<tr>
<td>EMT</td>
<td>Electrical Metallic Tubing</td>
</tr>
<tr>
<td>ETL</td>
<td>Edison Testing Laboratories</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>HHD</td>
<td>Hand Held Device</td>
</tr>
<tr>
<td>HOA</td>
<td>Hand-Off-Automatic</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilating and Air-Conditioning</td>
</tr>
<tr>
<td>HTTP</td>
<td>Hyper-Text Transfer Protocol</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/output</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>LANID</td>
<td>LAN Interface Device</td>
</tr>
<tr>
<td>MAC</td>
<td>Medium Access Control</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>MS/TP</td>
<td>Master-Slave/Token-Passing</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
</tr>
<tr>
<td>ODBC</td>
<td>Open Database Connectivity</td>
</tr>
<tr>
<td>OI</td>
<td>Operator Interface</td>
</tr>
<tr>
<td>OWS</td>
<td>Operator Workstation</td>
</tr>
<tr>
<td>P</td>
<td>Proportional</td>
</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>PI</td>
<td>Proportional-Integral</td>
</tr>
<tr>
<td>PICS</td>
<td>Protocol Implementation Conformance Statement</td>
</tr>
<tr>
<td>PID</td>
<td>Proportional-Integral-Derivative</td>
</tr>
<tr>
<td>POT</td>
<td>Portable Operators Terminal</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<td>-----------------------------</td>
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</tr>
<tr>
<td>Accessible</td>
<td>Locations that can be reached with no more than a ladder to assist access and without having to remove permanent partitions or materials. Examples include inside mechanical rooms, mechanical equipment enclosures, instrument panels, and above suspended ceilings with removable tiles.</td>
</tr>
<tr>
<td>BACnet Interoperability</td>
<td>A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device in a specification.</td>
</tr>
<tr>
<td>Building Blocks</td>
<td></td>
</tr>
<tr>
<td>BACnet/BACnet Standard</td>
<td>BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.</td>
</tr>
<tr>
<td>Change of Value</td>
<td>An event that occurs when a digital point changes value or an analog value changes by a predefined amount.</td>
</tr>
<tr>
<td>Client</td>
<td>A device that is the requestor of services from a server. A client device makes requests of and receives responses from a server device.</td>
</tr>
<tr>
<td>Concealed</td>
<td>Embedded in masonry or other construction, installed in furred spaces, within double partitions, above hung ceilings, in trenches, in crawl spaces, or in enclosures.</td>
</tr>
<tr>
<td>Continuous Monitoring</td>
<td>A sampling and recording of a variable based on time or change of state (such as trending an analog value, monitoring a binary change of state).</td>
</tr>
<tr>
<td>Contract Documents</td>
<td>Specifications, drawings, and other materials provided with request for bids.</td>
</tr>
<tr>
<td>Control Systems Server</td>
<td>A computer(s) that maintain(s) the systems configuration and programming database.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------</td>
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</tr>
<tr>
<td>Controller</td>
<td>Intelligent stand-alone control device. Controller is a generic reference to BCs, AACs, and ASCs.</td>
</tr>
<tr>
<td>Direct Digital Control</td>
<td>Microprocessor-based control including Analog/Digital conversion and program logic.</td>
</tr>
<tr>
<td>Building Automation System</td>
<td>The entire integrated management and control system.</td>
</tr>
<tr>
<td>Equal</td>
<td>Approximately equal in material types, weight, size, design, quality, and efficiency of specified product.</td>
</tr>
<tr>
<td>Exposed</td>
<td>Not installed underground or concealed.</td>
</tr>
<tr>
<td>Furnish</td>
<td>To purchase, procure, acquire and deliver complete with related accessories.</td>
</tr>
<tr>
<td>Gateway</td>
<td>Bi-directional protocol translator connecting control systems that use different communication protocols.</td>
</tr>
<tr>
<td>Hand Held Device</td>
<td>Manufacturer’s microprocessor based portable device for direct connection to a field Controller.</td>
</tr>
<tr>
<td>Inaccessible</td>
<td>Locations that do not meet the definition of accessible. Examples include inside furred walls, pipe chases and shafts, or above ceilings without removable tiles.</td>
</tr>
<tr>
<td>Indicated, shown or noted</td>
<td>As indicated, shown or noted on drawings or specifications.</td>
</tr>
<tr>
<td>Install</td>
<td>To erect, mount and connect complete with related accessories.</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>Gauges, thermometers and other devices mounted in ductwork or piping that are not a part of the BAS.</td>
</tr>
<tr>
<td>IT LAN</td>
<td>Reference to the facility’s Information Technology network, used for normal business-related e-mail and Internet communication.</td>
</tr>
<tr>
<td>LAN Interface Device</td>
<td>Device or function used to facilitate communication and sharing of data throughout the BAS.</td>
</tr>
<tr>
<td>Local Area Network</td>
<td>Computer or control system communications network limited to local building or campus.</td>
</tr>
<tr>
<td>Master-Slave/Token Passing</td>
<td>Data link protocol as defined by the BACnet standard.</td>
</tr>
<tr>
<td>Motor Controllers</td>
<td>Starters, variable speed drives, and other devices controlling the operation of motors.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Native BACnet Device</td>
<td>A device that uses BACnet for communication. A device may also provide gateway functionality and still be described as a Native BACnet device.</td>
</tr>
<tr>
<td>Native BACnet System</td>
<td>A network composed only of Native BACnet Devices without gateways.</td>
</tr>
<tr>
<td>Open Database Connectivity</td>
<td>An open standard application-programming interface for accessing a database developed. ODBC compliant systems make it possible to access any data from any application, regardless of which database management system is handling the data.</td>
</tr>
<tr>
<td>Open Connectivity</td>
<td>OPC is an interoperability standard developed for industrial applications. OPC compliant systems make it possible to access or exchange data from any application, regardless of which database management system is handling the data.</td>
</tr>
<tr>
<td>Operator Interface</td>
<td>A device used by the operator to manage the BAS including OWSs, POTs, and HHDs.</td>
</tr>
<tr>
<td>Operator Workstation</td>
<td>The user's interface with the BAS system. As the BAS network devices are stand-alone, the OWS is not required for communications to occur.</td>
</tr>
<tr>
<td>Owner</td>
<td>The Owner or their designated representatives.</td>
</tr>
<tr>
<td>Piping</td>
<td>Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation and related items.</td>
</tr>
<tr>
<td>Points</td>
<td>All physical I/O points, virtual points, and all application program parameters.</td>
</tr>
<tr>
<td>Point-to-Point</td>
<td>Serial communication as defined in the BACnet standard.</td>
</tr>
<tr>
<td>Portable Operators Terminal</td>
<td>Laptop PC used both for direct connection to a controller and for remote dial up connection.</td>
</tr>
<tr>
<td>Primary Controlling LAN</td>
<td>High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs.</td>
</tr>
<tr>
<td>Protocol Implementation Conformance Statement</td>
<td>A written document that identifies the particular options specified by BACnet that are implemented in a device.</td>
</tr>
<tr>
<td>Provide</td>
<td>Furnish, supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.</td>
</tr>
<tr>
<td>Reviewed, approved, or directed</td>
<td>Reviewed, approved, or directed by or to Owner’s Representative.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Router</td>
<td>A device that connects two or more networks at the network layer.</td>
</tr>
<tr>
<td>Secondary Controlling LAN</td>
<td>LAN connecting AACs and ASCs.</td>
</tr>
<tr>
<td>Server</td>
<td>A device that is a provider of services to a client. A client device makes requests of and receives responses from a server device.</td>
</tr>
<tr>
<td>Standardized Query Language</td>
<td>SQL - A standardized means for requesting information from a database.</td>
</tr>
<tr>
<td>Supervisory LAN</td>
<td>Ethernet-based LAN connecting Primary Controller LANs with each other and OWSs, CSS, and THS. See System Architecture below.</td>
</tr>
<tr>
<td>Supply</td>
<td>Purchase, procure, acquire and deliver complete with related accessories.</td>
</tr>
<tr>
<td>Wiring</td>
<td>Raceway, fittings, wire, boxes and related items.</td>
</tr>
<tr>
<td>Work</td>
<td>Labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.</td>
</tr>
</tbody>
</table>

1.7 Quality Assurance

A. Materials and Equipment

1. See 2.1 for approved manufacturers.

B. Installer

1. The following are approved BAS contractors:

   a. EMCOR Mesa. Andy Brusch andy_bruch@emcorgroup.com

2. BAS Contractor’s Project Manager Qualifications: Individual shall specialize in and be experienced with direct digital control system installation for not less than 3 years. Project Manager shall have experience with the installation of the proposed direct digital control equipment product line for not less than 2 projects of similar size and complexity. Project Manager must have proof of having successfully completed the most advanced training offered by the manufacturer of the proposed product line.

3. BAS Contractor’s Programmer Qualifications: Individual(s) shall specialize in and be experienced with direct digital control system programming for not less than 3 years and with the proposed direct digital control equipment product line for not less than 1.5 years. Programmers must show proof of having successfully completed the most advanced
programming training offered by the vendor of the programming application on the proposed product line.

4. BAS Contractor’s Lead Installation Technician Qualifications: Individual(s) shall specialize in and be experienced with direct digital control system installation for not less than 3 years and with the proposed direct digital control equipment product line for not less than 1.5 years. Installers must show proof of having successfully completed the installation certification training offered by the vendor of the proposed product line.

5. BAS Contractor’s Service Qualifications: The installer must be experienced in control system operation, maintenance and service. BAS Contractor must document a minimum 5-year history of servicing installations of similar size and complexity. Installer must also document at least a 1-year history of servicing the proposed product line.

6. Electrical installation shall be by manufacturer-trained electricians

   a. Exception: Roughing in wiring and conduit and mounting panels may be subcontracted to any licensed electrician.

1.8 Submittals

A. No work may begin on any segment of this Project until the related submittals have been reviewed for conformity with the design intent and the Contractor has responded to all comments to the satisfaction of the Owner’s Representative.

B. Submit drawings and product data as hereinafter specified. Conditions in this Section take precedence over conditions in Division 1 or Section 23 05 00.

C. Submittal Schedule: Submittal schedule shall be as follows unless otherwise directed by the Owner’s Representative:

   1. Allow 10 working days for approval, unless Owner’s Representative agrees to accelerated schedule.

   2. Submittal Package 0 (Qualifications) shall be submitted with bid.

   3. Submittal Package 1 (Hardware and Shop Drawings) shall be submitted in accordance with schedule established by the Owner in bid documents.

   4. Submittal Package 2 (Programming and Graphics) and shall be submitted no less than 30 days before software is to be installed in field devices.

   5. Submittal Package 3 (Training Materials) shall be submitted no less than 14 days prior to conducting first training class.

   6. Submittal Package 4 (Post-Construction Trend Logs) shall be submitted after demonstration tests are accepted and systems are in full automatic
operation. The list of points to be trended shall be submitted for approval 14 days prior to the start of the trend collection period.

D. Submission and Resubmission Procedure

1. Optional Pre-Submittals. At Contractor’s option, electronic submittals indicated below may be submitted unofficially via email directly to the Engineer for review and comment prior to formal submission. Comments provided by the Engineer are not official and may be changed or additional comments may be provided on the formal submittal. The intent of pre-submittals is to reduce paperwork and review time.

2. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submittal for that specification section, such as SUBMITTAL 23 09 00-01.

3. Each resubmittal shall have the original unique serial number plus unique revision number such as SUBMITTAL 23 09 00-01 REVISION 1.

4. Submit one copy of submittal in electronic format specified under each submittal package below. Submissions made in the wrong format will be returned without action.

5. Owner’s Representative will return a memo or mark-up of submittal with comments and corrections noted where required.

6. Make corrections
   a. Revise initial submittal to resolve review comments and corrections.
   b. Indicate any changes that have been made other than those requested.
   c. Clearly identify resubmittal by original submittal number and revision number.

7. Resubmit revised submittals until no exceptions are taken.

8. Once submittals are accepted with no exceptions taken, provide
   a. Complete submittal of all accepted drawings and products in a single electronic file.
   b. Photocopies or electronic copies for coordination with other trades, if and as required by the General Contractor or Owner’s Representative.

E. Submittals Packages

1. Submittal Package 0 (Qualifications)
a. Provide Installer and Key personnel qualifications as specified in Paragraph 1.7B.

b. Format: Word-searchable format

2. Submittal Package 1 (Hardware and Shop Drawings)

a. Hardware

1) Organize by specification section and device tags

2) Do not submit products that are not used even if included in specifications.

3) Include a summary table of contents listing for every submitted device:
   a) Tab of submittal file/binder where submittal is located
   b) Device tag
   c) Specification section number (down to the lowest applicable heading number)
   d) Whether device is per specifications and a listed product or a substitution
   e) Manufacturer
   f) Model number
   g) Device accuracy (where applicable)

4) Submittal shall include manufacturer’s description and technical data, such as performance data and accuracy, product specification sheets, and installation instructions for all control devices and software.

5) When manufacturer’s cut-sheets apply to a product series rather than a specific product, the data specifically applicable to the Project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements.

6) Format: Word-searchable format

b. Shop Drawings
1) System architecture one-line diagram indicating schematic location of all control units, workstations, LAN interface devices, gateways, etc. Indicate address and type for each control unit. Indicate media, protocol, baud rate, and type of each LAN.

2) Schematic flow diagram of each air system showing fans, coils, dampers, heat exchange equipment and control devices.

3) All physical points on the schematic flow diagram shall be indicated with names, descriptors, and point addresses identified as listed in the point summary table.

4) Label each input and output with the appropriate range.

5) Device table (Bill of Materials). With each schematic, provide a table of all materials and equipment including:
   a) Device tag as indicated in the schematic and actual field labeling
   b) Description
   c) Proposed manufacturer and model number
   d) Range
   e) Quantity

6) Indicate all required electrical wiring. Electrical wiring diagrams shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

7) Details of control panels, including controllers, instruments, and labeling shown in plan or elevation indicating the installed locations.

8) Format
   a) Sheets shall be consecutively numbered.
   b) Each sheet shall have a title indicating the type of information included and the mechanical/electrical system controlled.
   c) Table of Contents listing sheet titles and sheet numbers.
   d) Legend and list of abbreviations.
e) Schematics

1. Word searchable pdf format.

2. 21 inch x 15 inch or 17 inch x 11 inch.

c. Do not include sequence of controls on shop drawings or equipment submittals; they are included in Submittal Package 2.

3. Submittal Package 2 (Programming and Graphics)

a. A detailed description of point naming convention to be used for all software and hardware points, integrated with existing database convention.

b. A list of all hardware and software points identifying their full text names, device addresses and descriptions.

c. Control Logic Documentation

1) Submit control logic program listings (graphical programming) consistent with specified English-language Sequences of Operation for all control units.

2) Control logic shall be annotated to describe how it accomplishes the sequence of operation. Annotations shall be sufficient to allow an operator to relate each program component (block or line) to corresponding portions of the specified Sequence of Operation.

3) Include specified English-language Sequences of Operation of each control sequence updated to reflect any suggested changes made by the Contractor to clarify or improve the sequences. Changes shall be clearly marked. SOO shall be fully consistent with the graphical programming.

4) Include control settings, setpoints, throttling ranges, reset schedules, adjustable parameters and limits.

5) Submit one complete set of programming and operating manuals for all digital controllers concurrently with control logic documentation.

d. Graphic screens of all required graphics, provided in final colors.

e. Format

1) Points list: Word-searchable format

2) Programming and operating manual: Word-searchable format

3) Graphics: Graphical electronic format (pdf, png, etc.).
4. Submittal Package 3 (Training Materials)
   a. Provide training materials as required by Paragraph 3.11.
   b. Format: Word-searchable format

5. Submittal Package 4 (Trend Logs)
   a. Provide a list of points being trended along with trend interval or change-of-value.

1.9 Completion Requirements

A. Procedure

1. Until the documents required in this Section are submitted and approved, the system will not be considered accepted and final payment to Contractor will not be made.

2. Before requesting acceptance of Work, submit one set of completion documents for review and approval of Owner.

3. After review, furnish quantity of sets as indicated by Owner.

B. Completion Documents

1. Operation and Maintenance (O & M) Manuals. Provide in both paper and electronic format
   a. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual.
   b. As-built versions of the submittal product data. Submittal data shall be located in tabs along with associated maintenance information.
   c. Engineering, Installation, and Maintenance Manual(s) that explain how to design and install new points, panels, and other hardware; preventive maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.
   d. Complete original issue documentation, installation, and maintenance information for all third-party hardware and software provided, including computer equipment and sensors.
   e. A list of recommended spare parts with part numbers and suppliers.
   f. Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point reports,
trending data, overriding computer control, and changing set points
and other variables.

g. Programming Manuals with a description of the programming
language, control block descriptions (including algorithms and
calculations used), point database creation and modification, program
creation and modification, and use of the programming editor.

h. Recommended preventive maintenance procedures for all system
components, including a schedule of tasks (inspection, cleaning,
calibration, etc.), time between tasks, and task descriptions.

i. A listing and documentation of all custom software for the Project
created using the programming language, including the set points,
tuning parameters, and point and object database.

j. English language control sequences updated to reflect final
programming installed in the BAS at the time of system acceptance.

k. A BACnet Protocol Implementation Conformance Statement (PICS)
for each type of controller and operator interface.

2. Complete original issue electronic copy for all software provided,
including operating systems, programming language, operator
workstation software, and graphics software.

3. Complete electronic copy of BAS database, user screens, setpoints and
all configuration settings necessary to allow re-installation of system after
crash or replacement of server, and resume operations with the BAS in
the same configuration as during owner sign-off.

4. Project Record Drawings

   a. As-built versions of the submittal drawings in reproducible paper and
electronic format

   b. As-built network architecture drawings showing all BACnet nodes
   including a description field with specific controller and device
   identification, description and location information.

5. Copy of inspection certificates provided by the local code authorities.

6. Written guarantee and warranty documents for all equipment and
systems, including the start and end date for each.

7. Training materials

8. Contact information. Names, addresses, and 24-hour telephone numbers
of contractors installing equipment, and the control systems and service
representatives of each.
C. Format of Completion Documents

1. Provide the type and quantity of media listed in table below.

2. Project database, programming source files, and all other files required to modify, maintain, or enhance the installed system shall be provided in their source format and compiled format (where applicable).

3. Where electronic copies are specified, comply with the following:
   a. Provide in word-searchable electronic format; acceptable formats are MS Word, Adobe Acrobat (pdf), and HTML; submit other formats for review and approval prior to submission; scanned paper documents not acceptable.
   b. For submittals, provide separate file for each type of equipment.
   c. Control sequences shall be in MS Word.

D. Permanent On-site Documentation

1. In panels, provide the following in a sufficiently permanent manner such that documentation cannot be easily removed (and lost):
   a. Point list of all points in panel.
   b. Shop drawings for devices in panel.

1.10 BAS Design

A. System Architecture

1. General
   a. The system provided shall incorporate hardware resources sufficient to meet the functional requirements specified in this Section. Include all items not specifically itemized in this Section that are necessary to implement, maintain, and operate the system in compliance with the functional intent of this Section.
   b. The system shall be configured as a distributed processing network(s) capable of expansion as specified herein.
   c. All control products provided for this Project shall comprise an interoperable Native BACnet System. All control products provided for this Project shall conform to ANSI/ASHRAE Standard 135.
a. Primary Controller LAN (Primary LAN): High-speed, peer-to-peer communicating LAN used to connect BCs, AACs, and certain gateways where specified herein. The Primary LAN communicates exclusively control information. Acceptable technologies include and are limited to:

1) Ethernet (IEEE802.3)
2) ARCNET (IEEE802.4)

b. Secondary Controller LAN (Secondary LAN): Network used to connect ASCs and certain gateways where specified herein. These may be Master Slave/Token Passing (MS/TP) in addition to those allowed for Primary Controller LANs. Network speed versus the number of controllers on the LAN shall be dictated by the response time and trending requirements.

3. Operator Interfaces and Servers. The Control Systems Server (CSS) and Operator interface devices are existing. No additional CSS, OWS, or POT shall be provided as a part of this project. See Paragraph 1.3 for temporary CSS requirements.

4. Controllers. The BCs, AACs, and ASCs shall monitor, control, and provide the field interface for all points specified.

5. Gateways

   a. Where gateways are used, critical points shall be hardwired from the BAS to the controlled device, rather than using the gateway, to avoid problems with gateway failures, currently a common problem. Critical points are those that are essential for proper operation and are listed in points list as separate points. Where listed, these points shall be hardwired even when available through gateway.

B. System Performance

   1. The communication speed between the controllers, LAN interface devices, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition. In no case shall delay times between an event, request, or command initiation and its completion be greater than those listed herein, assuming no other simultaneous operator activity. Reconfigure LAN as necessary to accomplish these performance requirements. This does not apply to gateways and their interaction with non-BAS-vendor equipment.

   a. Object Command: The maximum time between an operator command via the operator interface to change an analog or binary point and the subsequent change in the controller shall be less than 5 seconds.
b. Object Scan: All changes of state and change of analog values will be transmitted over the network such that any data used or displayed at a controller or workstation will have been current within the previous 10 seconds.

c. Graphics Scan: The maximum time between an operator’s selection of a graphic and it completely painting the screen and updating at least 10 points shall be less than 10 seconds.

d. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation or broadcast (where so programmed) shall not exceed 10 seconds for a Level 1 alarm, 20 seconds for alarm levels 2 and 3, and 30 seconds for alarm levels 4 and 5. All workstations on the onsite network must receive alarms within 5 seconds of each other.

e. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every 5 seconds. Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

f. Control Loop Performance: Programmable controllers shall be able to execute DDC PID control loops at a selectable frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

1.11 Ownership of Proprietary Material

A. All project-developed software and documentation shall become the property of the Owner. These include, but are not limited to:

1. Project graphic images
2. Record drawings
3. Project database
4. Project-specific application programming code
5. All documentation

1.12 Warranty

A. At the successful completion of the final testing, and demonstration phase in accordance with the terms of this specification, if equipment and systems are operating satisfactorily to the Owner and if all completion requirements have been fulfilled, the Owner shall certify in writing that the control system has been accepted. The date of acceptance shall be the start of the warranty period.
B. Guarantee all materials, equipment, apparatus and workmanship (including programming) to be free of defective materials and faulty workmanship for the following periods from date of acceptance:

1. BCs, AACs, and ASCs: two years
2. All else: one year

C. Provide new materials, equipment, apparatus and labor to replace that determined by Owner to be defective or faulty.

D. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. Contractor shall respond to the Owner’s request for warranty service within 24 hours during normal business hours.

E. Operator workstation software, project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies shall be provided at no cost to the Owner during the warranty period.

F. Sequence of operation programming bugs (both due to programming misinterpretations and sequence errors) shall be corrected and any reasonable control sequence changes required to provide proper system operation shall be provided at no additional cost to the Owner during this period.

1.13 Warranty Maintenance

A. The Owner reserves the right to make changes to the BAS during the warranty period. Such changes do not constitute a waiver of warranty. The Contractor shall warrant parts and installation work regardless of any such changes made by the Owner, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the BAS.

B. At no cost to the Owner, provide maintenance services for software and hardware components during the warranty period as specified below:

1. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired following notification by the Owner to the Contractor.

   a. Response by telephone or via internet connection to the BAS to any request for service shall be provided within two hours of the Owner’s initial request for service.

   b. In the event that the malfunction, failure, or defect is not corrected, at least one technician, trained in the system to be serviced, shall be
dispatched to the Owner’s site within eight hours of the Owner’s initial request for such services.

2. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired following notification by the Owner to the Contractor.
   
a. Response by telephone to any request for service shall be provided within eight working hours (contractor specified 40 hr. per week normal working period) of the Owner’s initial request for service.
   
b. In the event that the malfunction, failure, or defect is not, at least one technician, trained in the system to be serviced, shall be dispatched to the Owner’s site within three working days of the Owner’s initial request for such services, as specified.

3. Owner’s Telephonic Request for Service: Contractor shall specify a maximum of three telephone numbers for Owner to call in the event of a need for service. At least one of the lines shall be attended continuously (24/7).

4. Technical Support: Contractor shall provide technical support by telephone throughout the warranty period.

5. Documentation: Record drawings and software documentation shall be updated as required to reflect any and all changes made to the system or programming during the warranty period.

PART 2 PRODUCTS

2.1 Primary BAS Manufacturer
   
   A. Andover.
   
   B. No Equal

2.2 General

   A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way.

   B. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer.

   C. All controllers, associated hardware (repeaters, routers, etc.), sensors, and control devices shall be fully operational and maintain specified accuracy at the anticipated ambient conditions of the installed location.

   D. BACnet Gateways & Routers
1. Gateways shall be provided to link non-BACnet control products to the BACnet inter-network. Each Gateway shall have the ability to expand the number of BACnet objects of each type supported by 20% to accommodate future system changes.

2. Each Gateway shall provide values for all points on the non-BACnet side of the Gateway to BACnet devices as if the values were originating from BACnet objects. The Gateway shall also provide a way for BACnet devices to modify (write) all points specified by the Points List using standard BACnet services.

2.3 BAS Interface Hardware

A. Not required (existing)

2.4 Electric Wiring and Devices

A. All electrical work shall comply with Division 26.

B. Communication Wiring

1. Provide all communication wiring between Building Controllers, Routers, Gateways, AACs, ASCs and local and remote peripherals (such as operator workstations and printers).

2. Ethernet LAN: Use Fiber or Category 5 or 6 of standard TIA/EIA 68 (10baseT). Network shall be run with no splices and separate from any wiring over 30 volts.

3. ARCnet and MS/TP LAN: Communication wiring shall be individually 100% shielded pairs per manufacturers recommendations for distances installed, with overall PVC cover, Class 2, plenum-rated run with no splices and separate from any wiring over 30 volts. Shield shall be terminated and wiring shall be grounded as recommended by BC manufacturer.

2.5 Control Cabinets

A. All control cabinets shall be fully enclosed with hinged door and quarter-turn slotted latch.

B. Construction

1. Indoor: NEMA 1

2. Outdoor: NEMA 3R

2.6 Software

A. General
1. System software shall be the latest version

B. Licensing

1. Include licensing and hardware keys for all software packages at all workstations (OWSs and POTs) and servers.

2. Within the limitations of the server, provide licenses for any number of users to have web access to the CSS at any given time.

3. All operator interface, programming environment, networking, database management and any other software used by the Contractor to install the system or needed to operate the system to its full capabilities shall be licensed and provided to the Owner.

4. All operator software, including that for programming and configuration, shall be available on all workstations. Hardware and software keys to provide all rights shall be installed on all workstations.

C. Graphical User Interface Software

1. Graphics
   a. The GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated graphics and active setpoint graphic controls shall be used to enhance usability.

   b. Graphics tools used to create Web Browser graphics shall be non-proprietary and provided and installed on each OWS.

   c. Links
      1) Graphics shall include hyperlinks which when selected (clicked on with mouse button) launch applications, initiate other graphics, etc.

   d. Point Override Feature
      1) Every real output or virtual point displayed on a graphic shall be capable of being overridden by the user (subject to security level access) by mouse point-and-click from the graphic without having to open another program or view.

      2) A list of points that are currently in an operator mode shall be available through menu selection.

2. Trends
   a. Trend Data Storage
1) The database shall allow applications to access the data while the database is running. The database shall not require shutting down in order to provide read-write access to the data. Data shall be able to be read from the database without interrupting the continuous storage of trend data being carried by the BAS.

2) Data shall be stored in an SQL compliant database format and shall be available through the Owner’s intranet or internet (with appropriate security clearance) without having to disable BAS access to the database.

3) The database shall not be inherently limited in size, e.g. due to software limitations or lack of a correct license. Database size shall be limited only by the size of the provided storage media (hard drive size).

PART 3 EXECUTION

3.1 Installation - General

A. Install systems and materials in accordance with manufacturer’s instructions.

B. Coordinate Work and Work schedule with other trades prior to construction.

C. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Delivery, Storage, and Handling

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons during shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment.

B. Store equipment and materials inside and protect from weather.

3.3 Identification

A. General

1. Manufacturers’ nameplates and UL or CSA labels to be visible and legible after equipment is installed.

2. All plug-in components shall be labeled such that removal of the component does not remove the label.

B. Wiring and Tubing
1. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2 inches of termination with the BAS address or termination number.

2. Permanently label or code each point of field terminal strips to show the instrument or item served.

3.4 Cutting, Coring, Patching and Painting

A. Provide canning for openings in concrete walls and floors and other structural elements prior to their construction.

B. Penetrations through rated walls or floors shall be filled with a listed material to provide a code compliant fire-stop.

C. At the completion of Work, all equipment furnished under this Section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired and repainted to original finish.

3.5 Cleaning

A. Clean up all debris resulting from its activities daily. Remove all cartons, containers, crates, and other debris generated by Work in this Section as soon as their contents have been removed. Waste shall be collected and legally disposed of.

B. Materials stored on-site shall be protected from weather and stored in an orderly manner, neatly stacked, or piled in the designated area assigned by the Owner’s Representative.

C. At the completion of work in any area, clean all work and equipment of dust, dirt, and debris.

D. Use only cleaning materials recommended by the manufacturer of the surfaces to be cleaned and on surfaces recommended by the cleaning material manufacturer.

3.6 Communication Devices

A. General

1. Install systems and materials in accordance with manufacturer’s instructions.

2. Provide all interface devices and software to provide an integrated system.

B. External Communications

1. Provide an Ethernet second port on the CSS to which the Owner can connect their Owner IT LAN (intranet), by others. Contractor shall
coordinate with the Owner’s Representative to establish an IP address and communications parameters to assure proper operation. This connection shall also provide access to Internet through Owner’s firewall to Internet Services Provider procured by Owner.

3.7 Control Power

A. Power wiring and wiring connections required for Work in this Section shall be provided under this Section unless specifically indicated on Division 26 Drawings or Specifications.

B. Extend power to all BAS devices, including 120V power to panels, from an acceptable power panel.

1. See Division 26 Electrical Drawings for power locations pre-allocated for BAS system.

2. Where no power source is indicated on drawings, for bid purposes only, assume a dedicated circuit is available within an average of 20 feet of panel location. If this is not the case, request additional cost prior to submission of shop drawings or no additional costs will be reimbursed.

3. Coordinate with Division 26 during shop drawing development for final connection location.

3.8 Control and Communication Wiring

A. Control and Signal Wiring


2. Line Voltage Wiring

   a. All line-voltage wiring shall meet NEC Class 1 requirements.

   b. All Class 1 wiring shall be installed in UL Listed approved raceway per NEC requirements and shall be installed by a licensed electrician.

   c. Class 1 wiring shall not be installed in raceway containing pneumatic tubing.

3. Low Voltage Wiring

   a. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)

   b. Class 2 wiring shall be installed in UL Listed approved raceway as follows:

      1) Where located in unconcealed or inaccessible locations, such as:
a) Equipment rooms  
b) Exposed to weather  
c) Exposed to occupant view  
d) Inaccessible locations such as concealed shafts and above inaccessible ceilings

2) Class 2 wiring shall not be installed in raceway containing Class 1 wiring.

c. Class 2 wiring need not be installed in raceway as follows:

1) Where located in concealed and easily accessible locations, such as:

a) Inside mechanical equipment enclosures and control panels  
b) Above suspended accessible ceilings (e.g. lay-in and spline)  
c) Above suspended drywall ceilings within reach of access panels throughout  
d) In shafts within reach of access panels throughout  
e) Nonrated wall cavities

2) Wiring shall be UL Listed for the intended application. For example, cables used in floor or ceiling plenums used for air transport shall be UL Listed specifically for that purpose.

3) Wiring shall be supported from or anchored to structural members neatly tied at 10 foot intervals and at least 1 foot above ceiling tiles and light fixtures. Support or anchoring from straps or rods that support ductwork or piping is also acceptable. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceilings.

4) Install wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

d. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two (for example relays and transformers).

4. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

5. All field wiring shall be properly labeled at each end, with self-laminating typed labels indicating device address, for easy reference to the
identification schematic. All power wiring shall be neatly labeled to indicate service, voltage, and breaker source.

6. Use coded conductors throughout with different colored conductors.

7. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

8. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the Contractor shall provide step-down transformers.

9. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.

10. Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer’s recommendation and NEC requirements.

11. Include one pull string in each raceway 1 inch or larger.

12. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

13. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 6 inches from high-temperature equipment (for example steam pipes or flues).

14. Secure raceways with raceway clamps fastened to the 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.

15. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

16. Terminate all control or interlock wiring.

17. Maintain updated as-built wiring diagrams with terminations identified at the jobsite.

18. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3 feet in length and shall be supported at each end. Flexible metal raceway less than ½ inches electrical trade size shall not be used. In areas exposed to moisture liquid-tight, flexible metal raceways shall be used.

19. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings per code. Terminations must be
made with fittings at boxes and ends not terminating in boxes shall have bushings installed.

20. Shielded cable shield shall be grounded only at one end. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.

B. Communication Wiring

1. Communication and signal wiring may be run without conduit in concealed, accessible locations only if noise immunity is ensured. Contractor is fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.

2. All cabling shall be installed in a neat and workmanlike manner. Follow all manufacturers’ installation recommendations for all communication cabling.

3. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

4. Maximum pulling, tension, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.

5. Verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

6. All runs of communication wiring shall be unspliced length when that length is commercially available.

7. All communication wiring shall be labeled to indicate origination and destination data.

8. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communications Circuits, Cable and Protector Grounding.

9. Power-line carrier signal communication or transmission is not acceptable.

3.9 Software Installation

A. System Configuration

1. Thoroughly and completely configure BAS system software, supplemental software, network software etc. on OWS, POTs, and servers.

B. Point Structuring and Naming

1. The intent of this Paragraph is to require a consistent means of naming points across the BAS. The following requirement establishes a standard
for naming points and addressing Buildings, Networks, Devices, Instances, etc.

2. Point Summary Table

a. The term “Point” includes all physical I/O points, virtual points, and all application program parameters.

b. With each schematic, provide a Point Summary Table listing

   1) Building number and abbreviation
   2) System type
   3) Equipment type
   4) Point suffix
   5) Full point name
   6) Point description
   7) Ethernet backbone network number
   8) Network number
   9) Device ID
   10) Device MAC address
   11) Object ID (object type, instance number)
   12) Engineering units
   13) Device make and model number; include range of device if model number does not so identify.
   14) Device physical location description; include floor and column line intersection to one decimal place (for example line 6.2 and line A.3).

c. Point Summary Table shall be provided in both hard copy and in a relational database electronic format (ODBC-compliant).

d. Coordinate with the Owner’s representative and compile and submit a proposed Point Summary Table for review prior to any object programming or Project startup.

e. The Point Summary Table shall be kept current throughout the duration of the Project by the Contractor as the Master List of all points for the Project. Project closeout documents shall include an
3. Device Addressing Convention

   a. BACnet network numbers and Device Object IDs shall be unique throughout the network.

   b. All assignment of network numbers and Device Object IDs shall be coordinated with the Owner to ensure there are no duplicate BACnet device instance numbers.

   c. Each Network number shall be unique throughout all facilities and shall be assigned in the following manner: VVVNN, where: VVV = 0-999 for BACnet Vendor ID, NN = 00 - 99 for building network.

   d. Each Device Object Identifier property shall be unique throughout the system and shall be assigned in the following manner: VVVNNND, where: VVV = number 0 to 999 for BACnet Vendor ID, NN = 00 - 99 for building network, DD = 01-99 for device address on a network.

   e. Coordinate with the Owner or a designated representative to ensure that no duplicate Device Object IDs occur.

   f. Alternative Device ID schemes or cross-project Device ID duplication if allowed shall be approved before Project commencement by the Owner.

4. I/O Point Physical Description

   a. Each point associated with a hardware device shall have its BACnet long-name point description field filled out with:

C. Site-Specific Application Programming

1. All site specific application programming shall be written in a manner that will ensure programming quality and uniformity. Contractor shall ensure:

   a. Programs are developed by one programmer, or a small group of programmers with rigid programming standards, to ensure a uniform style.

   b. Programs for like functions are identical, to reduce debugging time and to ease maintainability.

   c. Programs are thoroughly debugged before they are installed in the field.
2. Massage and tune application programming for a fully functioning system. It is the Contractor’s responsibility to request clarification on sequences of operation that require such clarification.

D. Graphic Screens

1. All site specific graphics shall be developed in a manner that will ensure graphic display quality and uniformity among the various systems.

2. Schematics of MEP systems
   a. Schematics shall be 2-D or 3-D
   b. All relevant I/O points and setpoints being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with the mouse.
   c. Animation or equipment graphic color changes shall be used to indicate on/off status of mechanical components.
   d. Indicate all adjustable setpoints and setpoint high and low limits (for automatically reset setpoints), on the applicable system schematic graphic or, if space does not allow, on a supplemental linked-setpoint screen.

3. Displays shall show all points relevant to the operation of the system, including setpoints.

4. The current value and point name of every I/O point and setpoint shall be shown on at least one graphic and in its appropriate physical location relative to building and mechanical systems.

5. Show weather conditions (local building outside air temperature and humidity) in the upper left hand corner of every graphic.

E. Alarm Configuration

1. Program alarms and alarm levels per Sequence of Operations.

3.10 Sequences of Operation

A. General

1. See drawings for sequence of operation.

2. Contractor shall review sequences prior to programming and suggest modifications where required to achieve the design intent. Contractor
may also suggest modifications to improve performance and stability or to simplify or reorganize logic in a manner that provides equal or better performance. Proposed changes in sequences shall be included as a part of Submittal Package 2.

3. Include costs for minor program modifications if required to provide proper performance of the system.

3.11 TRAINING

A. Formal Training

1. Training shall be conducted after systems are fully operational.

2. Andover Training

   a. It may be assumed that building engineers have been previously trained on the existing Andover system.

   b. Include training on Andover system operations only for new features installed at CSS/OWS as a part of this project.

3. Jobsite Training

   a. Include 16 hours total of on-site training to assist personnel in becoming familiar with job-specific issues, systems, control sequences, etc.

   b. Owner shall be permitted to videotape training sessions.

4. Training may be in non-contiguous days at the request of the Owner

5. During the warranty period, provide unlimited telephone support for all trained operators.

END OF SECTION 23 09 00
SECTION 01 91 13 - COMMISSIONING

PART I. GENERAL

1.1 WORK INCLUDED

A. Commissioning requirements common to all Sections.
B. Systems and equipment start-up and functional performance testing.
C. Validation of proper and thorough installation of systems and equipment
D. Equipment performance verification.
E. Documentation of tests, procedures, and installations.
F. Sequencing

1.2 GENERAL DESCRIPTION

A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Owner’s operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
B. Commissioning Authority shall work with the Contractor and the Design Engineer to direct and oversee the Cx process and perform functional performance testing.
C. This Section and other Sections of the specification details the Contractor’s responsibilities relative to the Cx process.

1.3 SCOPE

A. This Section covers elements, requirements, procedures, and protocols common across all Divisions of the work. Requirements specific to individual Sections are generally specified in the technical specification as well as a dedicated Section for each of Divisions 15 and 16 namely ‘230800 – Commissioning of HVAC System’ and ‘230810 - Commissioning of HVAC System Supplement’.

1.4 RELATED WORK AND DOCUMENTS

A. Division 1 sections – stipulates the requirements for meetings, documentation, O&M, close out, etc, involved with the Cx process.
B. Section 01 91 16 – Functional Performance Testing Procedures: Provides information regarding functional performance testing procedures to illustrate the level-of-effort expected during acceptance testing.
C. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.
D. Section 23 08 00 – Commissioning of HVAC System: Details the commissioning procedures specific to Division 15 work.
E. Section 23 08 10 – Commissioning of HVAC System Supplement: Details the commissioning procedures specific to Division 15 work.
1.5 DEFINITIONS AND ABBREVIATIONS

A. **Acceptance Phase**: This is the phase of the project when the facility and its systems and equipment are inspected, tested, verified, and documented; and when most of the Functional Performance Testing and formal training occurs. This will generally occur after the Construction Phase is complete (start-up and checks have been accomplished). The Acceptance Phase typically begins with the acceptance of the ATC Demonstration and ends with Substantial Completion.

B. **Action Item (AI)**: Any issue that requires a response, completion, corrective or additional work, or any other action. Examples include a Request for Information (RFI), a work directive, a clarification request, a to-do item, an identified deficiency, or any other like item. Action Items must be categorized as appropriate.

C. **Action List**: This is a list that is maintained and updated by the CxA that includes all Action Items that relate to Cx activities.

D. **A/E**: General reference to the Architect/Engineer lead-design entity.

E. **ASHRAE**: American Society of Heating, Refrigerating, and Air Conditioning Engineers.

F. **Automatic Temperature Controls Contractor (ATC)**: Contractor responsible for providing the Building Automation System and automatic temperature controls specified in Sections 17000.

G. **Building Automation System (BAS)**: The computer-based control or automation system. May also be referred to as the FMS.

H. **Commissioning (Cx)**: The process of ensuring that all building systems perform interactively according to the design intent, the systems are efficient and cost effective and meet the Owner’s operational needs.

I. **Commissioning Authority (CA) or (CXA)**: The Party retained by the Owner who will oversee the Cx process, develop and stipulate many of the Cx requirements, manage the Cx process, and ensure and validate that systems and equipment are designed, installed and tested to meet the Owner’s requirements.

J. **Commissioning Coordinator (CxC)**: This refers to the Individual within each of the various Parties that is designated the POC for that Party relative to Cx activities.

K. **Commissioning Portal**: This is an internet hub for the collaboration on Cx information. This portal will act as a hub for posting electronic information.

L. **Commissioning Specifications (‘Cx Specs’)**: Includes separate Cx specification sections and Cx-related subsections of other specifications. All Contractor requirements relating to Cx should be conveyed within the Cx Specs. Cx Specs should be referenced but not duplicated within the Cx Plan (which is designed to govern non-Contractor-related issues).
M. **Commissioning Team (CxT):** The group of Parties involved in the commissioning process for any given system. The Cx Team will include a core group involved with all systems. This core group will typically include the CA the Owner’s Cx Coordinator (O/O-CxC) and the CM’s Cx Coordinator (CM-CxC). On any given system, the Cx Team will also include the Cx Coordinator for the Contractor(s) responsible for the system or equipment.

N. **Contractor:** As used herein, ‘Contractor’ is a general reference to the installing Party and can therefore refer to the CM, subcontractors, or vendors as inferred by its usage.

O. **Construction Manager (CM):** The party acting as the primary coordinator of all the major subcontractors (MC, EC, TAB, ATC, etc as applicable). This may also be the General Contractor (GC), in which case all references to CM shall apply to the GC.

P. **Construction Phase:** Phase of the project during which the facility is constructed and/or systems and equipment are installed and started. Contractor and subcontractors complete the installation, complete start-up documentation, submit O&M information, establish trends, and perform any other applicable requirements to get systems started. Contractor and Vendors may also conduct equipment specific training. The Construction Phase will generally end upon completed start-up and TAB of systems and equipment.

Q. **Contract Documents:** The documents governing the responsibilities and relationships between Parties involved in the design and construction of this project.

R. **Construction Documents:** Refers generally to the Contract Documents that dictate the details of the installation (all but item a. above).

S. **Deficiency:** A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

T. **Electrical Contractor (EC):** Contractor generally responsible for Div. 16 work

U. **Facility Management System (FMS):** Alternate reference to the computer-based control or automation system. May also be referred to as the BAS.

V. **Factory Authorized Representative:** An individual fully trained on the equipment and certified by the manufacturer to perform the respective task.

W. **Factory Testing:** Testing of equipment off-site at the manufacturer’s facility. May be witnessed by the members of the project team.

X. **Field Testing by Factory Authorized Representative:** On site testing of equipment conducted by a factory authorized representative.

Y. **Fire Alarm Contractor (FAC):** Contractor generally responsible for the fire alarm system installation specified in section 16721.

Z. **Fire Suppression Contractor (FSC):** Contractor generally responsible for the installation of the fire suppression system (sprinkler, standpipe, and fire pump) as specified in 15300.

AA. **Functional Completion:** A milestone that marks the completion of the Acceptance Phase and successful completion of the FPTs by the CA.

BB. **Functional Performance Testing (FPT):** The detailed and thorough testing of the building systems and the components and equipment making up those systems. References made to FPT throughout the documents are generally inclusive of ISFPT unless specifically indicated otherwise.

CC. **IAQ:** Indoor Air Quality

DD. **Integrated System Functional Performance Testing (ISFPT):** The detailed and thorough testing of the interactions of various systems in the building. ISFPTs are considered a subset of the overall concept of FPT and therefore references made to FPT generally will include ISFPTs unless specifically indicated otherwise.
EE. **Manufacturer’s Representative:** Either an individual in direct employ of the manufacturer of the applicable system, or an individual who is certified by that manufacturer to perform the applicable work for which the reference is made. This is synonymous with Factory Authorized Representative.

FF. **Mechanical Contractor (MC):** Contractor generally responsible for Div. 15 work.

GG. **O&M Manuals:** This term shall be reserved for referencing manufacturer-published O&M documents, which generally has no information specific to the specific facility.

HH. **Opposite Season:** The season opposite that when the majority of the testing occurs.

II. **Owner/Operator (O/O):** This is a combined reference to the both the Owner and the operators of the facility.

JJ. **Party:** Entity legally responsible for portion of work.

KK. **Point of Contact (POC):** General reference to the key individual within each Party.

LL. **Preliminary Service:** Systems/equipment are being used by the occupants although final adjusting, balancing, and functional performance testing is on-going.

MM. **Pre-Test:** Preliminary testing accomplished during a scheduled system outage to verify system functionality prior to placing the system/equipment into preliminary service.

NN. **Project Phases:** Phases of the project include the Construction Phase, Acceptance Phase, and Warranty Phase.

OO. **Project Officer (PO):** Individual or entity directly employed by the Owner who is in charge of the design and construction coordination for the project.

PP. **RFI:** Request for Information.

QQ. **Scheduled Outage:** A period of time, scheduled by Owner, in which the system is out-of-service or not to be used by occupants.

RR. **Start-Up:** Refers to the quality control process whereby the Contractor verifies the proper installation of a device or piece of equipment, executes the manufacturer's starting procedures, completes the Start-Up Checklist, energizes the device, verifies that it is in proper working order and ready for dynamic testing, and completes the Start-Up Tests.

SS. **Start-Up Checklist Item:** A list of items to inspect to verify proper installation of equipment or systems by the Contractor. Checklist items simply require a ‘Yes/No’ or ‘OK/Not’ response. These include primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension checked, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). Start-Up Checklist items are one component of the Start-Up Procedures (Start-Up Tests being the other).

TT. **Start-Up Procedures:** Refers to the combination of Start-Up Checklists and Start-Up Tests. Start-Up Procedures are typically performed by the Contractor with or without a formal Cx process. The Contractor documents the start-up process by completing and submitting the Start-Up Procedures. Start-up procedures may be a combination of those prepared by the CA, those performed included in the contractor’s quality assurance process, and those required by the manufacturer. Regardless of the context of the checklist or format of the form used to documents it, the reference to Start Up Procedures includes all the stated procedures.

UU. **Start-Up Test:** This is a test that may be involved with equipment start-up. It differs from a checklist item in that it requires more than a binary response - an observation, measurement, or sequence of events must be documented. Start-Up Tests are one component of the Start-Up Procedures (Start-Up Checklists being the other).

VV. **TAB:** Can refer to the test, adjust, and balance process or the Testing, Adjusting, and Balancing Contractor.
WW. **Testing Agency:** An independent agency typically retained by the Contractor to perform specialized testing of systems or equipment (most commonly electrical). The Testing Agency shall be qualified and equipped to perform the testing and shall submit appropriate qualifications.

XX. **Trending:** Monitoring and recording a history of parameters typically using the building automation system.

YY. **Vendor:** Refers to the organization that sold a system or equipment to the subcontractor. This may be a branch office of the manufacturer or a value added reseller.

ZZ. **Warranty Phase:** Includes the early occupancy of the building and can continue through the Warranty Period and at least into the opposite season from when it was initially tested.

1.6 **REFERENCE STANDARDS**


B. ASHRAE Guideline 4-2008, “Preparation of operating and Maintenance Documentation for Building Systems”

C. NEBB - Procedural Standards for Building Systems Commissioning

1.7 **DOCUMENTATION**

A. Contractor shall provide to the Commissioning Authority the following per the procedures specified herein:

1. **Draft Start-Up Procedures:** Contractor shall develop Start-up Procedures for all applicable equipment and systems along with the manufacturer’s application, installation and start-up procedures. CA will review draft and recommend approval.

2. **Schedule Updates:** Issue periodic updates to the construction schedule. Provide to the CA at least every month. Contractor shall use schedule to notify Cx team of scheduled start-up and training activities.

3. **Action Item Response:** Respond to Action Items to which Cx team members assign the Contractor responsibility.

4. **Completed Start-Up Procedures:** Completed Start-Up Procedure documentation for all applicable equipment and systems. CA will review prior to FPT.

5. **Completed Test and Balance (TAB) Reports,** in hand written format if necessary, within two days of completion of the work. CA will review and incorporate comments via the Design Engineer prior to functional performance test.

B. **Record Drawings:** Contractor shall maintain at the site an updated set of record or ‘As-Built’ documents reflecting actual installed conditions and all approved changes and modifications to the contract documents. Contractor shall provide access to the CA to review the As-Built and Record Drawings. Provide Record Drawings in accordance with Division 1.
1.8 COMMISSIONING SEQUENCING AND SCHEDULING

A. Refer to the sequencing illustration at the end of this Section for a conceptual graphical representation of the precedents related to the Cx tasks. These precedents are generally to be applied per system and/or per area. Where applicable, in order to expedite the close out of the facility, various systems can be in various stages of the commissioning process. CA and Contractor shall cooperate to schedule the Cx tasks to minimize the duration of the Cx activities.

B. Prior to submission of the baseline schedule, Scheduler will coordinate with the Commissioning Authority to specifically include the detailed tasks involved in the commissioning (Cx) process. Commissioning related tasks shall be coded as such to facilitate generating a Commissioning fragment that will be used during commissioning progress meetings.

C. The Cx Precedent Schedule will outline generic Cx tasks with precedents or prerequisites to each task. These tasks, which will be shown generically for typical systems, will apply to many systems. Contractor shall incorporate the tasks into EACH SYSTEM.

D. Contractor shall notify A/E, Owner, and CA in writing that systems are complete and ready for verification and functional performance testing. Notification shall be accompanied by a schedule showing the coordinated start date and task duration and all currently open precedent requirements.

E. Contractor shall notify CA at least 14 days in advance of any tests, start-ups, or training. CA shall witness selected tests and start-ups. Notification shall be written and be accompanied by a schedule showing the coordinated start date and task duration and all currently open precedent requirements. Failure to provide the required notification may result in the rescheduling or re-start of the systems to accommodate the Cx Agent’s attendance. Any delays or added costs due to the reschedule or re-start will be at the Contractor’s expense.

1.9 CONTRACTOR RESPONSIBILITIES

A. Construction Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Construction Phase.

1. Include Cx requirements in price and plan for work.

2. Designate a Cx Coordinator (CxC) from each major subcontractor with activities related to commissioning. These Cx Coordinators are to be the primary contacts for Cx activities. At a minimum, the MC, EC, FAC, ATC, TAB, CRC, O/O, and CM shall designate a Cx coordinator.

3. Attend Construction Phase Cx Kick Off Meeting. The Cx Coordinator and Project Manager from each major subcontractor shall attend at a minimum.

4. The Cx Coordinator shall attend all Cx progress meetings unless otherwise agreed to by the CA.

5. Remedy any deficiencies identified throughout construction.

6. Prepare and submit required draft Start-Up Procedures and submit along with the manufacturer’s application, installation and start-up information.

7. TAB shall submit sample balancing forms for approval prior to starting work.

8. Schedule and coordinate Cx efforts into the construction schedule. Incorporate the precedent diagram provided by the CA into the construction schedule. Indicate at a minimum all tasks enumerated on the precedent diagram for all systems.

9. Coordinate the work of subcontractors, vendors, manufacturers, and Testing Agencies provided with the bid, and ensure that they are informed of and are adhering to the requirements of the Cx process specified throughout the contract documents.

10. Develop and submit Temporary Conditioning Plan
11. Review the specific Functional Performance Test (FPT) procedures generated by the CA. Contractors, subcontractors and vendors shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.

12. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this section.

13. Start-up, test, adjust, and balance systems and equipment prior to verification and performance testing by the Commissioning Authority.

14. Record start-up and testing procedures on start-up forms or checklists and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the party actually performing the task or procedure.

15. Provide skilled technicians qualified to perform the work required.

16. Provide factory-trained and authorized technicians where required by the Contract Documents.

17. Tag equipment that is started with the Individual’s name and date.

18. Demonstrate the operation of all systems as specified.

19. Certify that systems have been installed and are operating per Contract Documents prior to Acceptance Testing.

20. Maintain an updated set of Record Documentation as required by the Contract Documents.

21. Copy the CA on indicated documentation.

22. Conduct and document Training events as required by applicable sections of the Specifications pertaining to each piece of equipment or system.

B. Acceptance Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Acceptance Phase.

1. Assist CA in functional performance testing. Assistance will generally include the following:
   a) Manipulate systems and equipment to facilitate testing as dictated in Section 01810.
   b) Provide any specialized instrumentation necessary for functional performance testing.
   c) Manipulate BAS and other control systems to facilitate functional performance testing as dictated Section 01810.

2. Correct any work not in accordance with Contract Documents.

3. Respond to all Action Items which are assigned to each respective Subcontractor. The response shall be done through the Project Portal or by responding to the Action Item e-mails sent out by the CA.

4. Maintain record documentation, and update and resubmit it after Functional Completion.

5. Compensate CA for additional site time incurred due to incompleteness of systems or equipment at time of Functional Performance Testing. Compensation will be made at the rate of $160/hours plus expenses.

C. Warranty Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Warranty Phase.

1. Provide warranty service;

2. Respond to and document Warranty issues

3. Participate as required in the opposite season testing;
1.10 EQUIPMENT SUPPLIER/VENDOR RESPONSIBILITIES

A. Construction Phase: The following delineates the commissioning-related responsibilities of the Equipment Supplier (and their subcontractors) during the Construction Phase.
   1. Provide shop drawings and product data.
   2. Support and/or participate in parts of Controls Integration meetings that pertain to the BAS control and monitoring of equipment supplied with packaged controls.
   3. Provide manufacturer’s application, installation and start-up instructions within 30 days of shop drawing/product data approval.
   4. Where factory-authorized start-up is specified, coordinate and participate in the specified commissioning process and document start-up on the appropriate forms.
   5. Review and approve Functional Test Procedures affecting supplied equipment.
   6. Consult on and resolve issues identified with equipment provided that do not conform to project plans and specifications.
   7. Where training is to be provided by factory-authorized personnel, provide required Training Plan information including course content for approval prior to conducting the training.
   8. Conduct and document Systems Training by applicable sections of the Specifications pertaining to each piece of equipment or system.
   9. Provide spare parts and materials as required by Specifications.
   10. Provide special tools as required by the Specifications.
   11. Provide and develop project-specific O&M content as required by the Project Specifications.
   12. Provide all warranties.

B. Acceptance Phase: The following delineates the commissioning-related responsibilities of the Equipment Supplier (and their subcontractors) during the Acceptance Phase.
   1. Participate in any Functional Testing Procedures required.
   2. Consult on and resolve issues identified relative to the supplied equipment.

C. Warranty Phase: The following delineates the commissioning-related responsibilities of the Equipment Supplier (and their subcontractors) during the Warranty Phase.
   1. Provide any warranty service required to the supplied equipment as applicable with the agreement with the Contractor.
   2. Maintain O&M content relative to supplied equipment.
   3. Provide technical support to the Owner’s facilities personnel.

1.11 CX KICK OFF/COORDINATION MEETING

A. CXA shall schedule and conduct a Cx coordination meeting near the beginning of construction. The following should be discussed at this meeting:
   1. CXA will present
      a) the Cx Documents
      b) requirements of Cx
      c) responsibilities of the construction parties
      d) management protocols
1.12 START-UP PROCEDURES AND DOCUMENTATION

A. **Purpose**: The Cx process requires that the normal quality control processes involved with preparing systems and equipment for operation are performed to a high standard of care and are thoroughly documented. These procedures shall be performed to all installed systems and equipment and no sampling strategy is used for the start-up process.

B. **Creation of Start-up Procedures**: Contractor shall refine the Start-Up Procedures for each type of equipment based on the generic Start-up Procedures provided by the CA. Contractor shall notify the CA when the procedures have been refined shall accompany such notification with a hard copy or electronic copy of manufacturer’s application, installation and start-up information. CA will review and approve the procedures prior to start-up activities. Appropriate subcontractors or vendors shall contribute to the development to meet the requirements of the Contract Documents. Start-Up Procedures shall be developed for the equipment being installed for this project and as such indicate all project-specific values, settings, targets, acceptance criteria, and other parameters as appropriate.

C. ‘Generic’ Start-Up Procedures: Refer to Sections 230810, and 260800, for generic Start-up Procedures for a variety of mechanical, electrical, and control systems. The content of these Start-Up Procedures shall provide the minimally acceptable content.

D. **Content of Start-Up Procedures**: Start-Up Procedures shall generally include the following for each item of equipment or system (as applicable):

1. Project-specific designation, location and service.
2. Indication of the Party performing and documenting the Start-Up Procedure.
3. Clear explanation of the inspection, test, measurement, and outcome with a Pass/Fail indication and a record of measure parameters.
4. Include a checklist item indicating that all O&M instructions, Warranties, and Record Documents have been completed and submitted.
5. Include a Start-up Checklist item indicating that proper maintenance clearances have been maintained.
6. Include a Start-up Checklist item indicating that special tools and/or spare tools required for normal operation and maintenance were turned over to the Owner.
7. Include Start-up Checklist item indicating that all required dependent or prerequisite equipment and systems were previously started successfully.

E. **Manufacturer’s Requirements**: Start-up Procedures shall incorporate all manufacturer-specified procedures. As applicable, include acceptance criteria specified therein. The manufacturer’s start-up and checkout procedures shall be submitted to the CA along with the Contractor’s draft Start-Up Procedure.

F. **Recording and Documentation of the Start Up**: Manufacturer’s start up protocols shall be executed and forms shall be completed by a qualified/authorized technician. These shall be submitted to the CA, prior to the Acceptance Phase.

G. **Recording and Documentation of Prefunctional Checklists and Tests**: Generally in concert with the witnessed formal start up process, the prefucntional tests and checklists shall be completed by a qualified technician. These shall be submitted to the CA, prior to the Acceptance Phase.
H. **CA Review**: CA shall review the draft Start-Up Procedures and request any additional information required to meet the Cx criteria. CA will also review and spot-check procedures during Functional Performance Testing.
I. **Sampling and Final Submission:** All (100% of) systems are started and documented per the approved procedures and NO sampling strategy is used. Completed Start-up and prefunctional checklists for all pieces of equipment shall be submitted to Commissioning Authority prior to any associated functional performance testing. Any outstanding item shall be clearly indicated and an associated Action Item must be entered to track resolution.

J. **Owner Access:** Contractor shall allow access by Owner representatives to inspect the equipment and ensure its proper operation. Owner will be allowed to affix service tags to equipment to track the proper maintenance.

1.13 **FUNCTIONAL PERFORMANCE TESTING**

A. The objective of Functional Performance Testing is to demonstrate that each system is operating according to the documented Design Intent Document and Contract Documents. Functional Performance Testing facilitates bringing the systems from a state of Substantial Completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

B. The logistics and procedures involved in Functional Performance Testing are outlined below and in Section 019113

1.14 **DEFICIENCIES IDENTIFIED DURING FUNCTIONAL TESTING**

A. **Non-Conformance.** Non-conformance deficiencies identified during Functional Performance Testing shall be resolved as follows:

1. The CA will record the results of the functional test in the project database. All deficiencies or non-conformance issues shall be noted as Action Items and reported to the CM.

2. Corrections of identified minor deficiencies may be made during the tests at the discretion of the CA. In such cases the deficiency and associated resolution will be documented in the database.

3. Every effort will be made by the CA to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.

4. As tests progress and a deficiency is identified, the CA will discuss the issue with the executing Contractor.

   a) When there is no dispute on the deficiency and the Contractor accepts responsibility to correct it:

      1) The CA shall document the deficiency along with the Contractor’s response and intentions, and they go on to another test or sequence. A copy/email of the deficiency shall be generated and provided to the Contractor and CA. The Contractor corrects the deficiency, completes the Action Item response certifying that the issue is resolved and/or the equipment is ready to be retested, and sends it back to the CA.

      2) The CA reschedules the test and the test is repeated.

   b) When there is a dispute regarding the deficiency, the discussion will expand and may include the contractor PM, prime contractor PM, general contractor PM, mechanical designer, electrical designer, architect or owner’s representatives as necessary to resolve who is the responsible party, if any exists, and the nature of the resolution.

B. **Cost of Retesting:** The cost for the CA to retest a Start-up or Functional Performance Test shall be paid by the Contractor responsible for the deficiency. Owner shall pay the CA directly and back charge the responsible Contractor.
1.15 TEMPORARY CONDITIONING

A. Contractor shall only use building permanent equipment to provide temporary conditioning on the approval of the AE, Owner, and the CA. Approval for such will only be given upon acceptance of a detailed plan provided by the individually involved subcontractors and compiled by the CM. The temporary conditioning plan shall consider/address the following at a minimum

B. Indicate that the full start up protocol as required by the specification for final acceptance will be performed for the temporary start up. Temporary conditioning plan shall include the start up forms to be used which will be the same as those that will be used for final start up.

C. Contractor shall address how equipment will be maintained in good, clean condition. Specifically address:

1. Temporary filtering of air: Air Filters used for construction shall be at least that specified for final use. Contractor shall remove construction filters and replace with new filters at substantial completion. Filters shall be maintained and replaced at the specified final pressure drop. Contractor shall install a magnehelic for visual indication of pressure drop as well as set up the loaded filter DP switch for monitoring on the BAS.

2. Temporary Filtering of Water and Condensate: Construction strainers shall be used while circulating fluid during construction. Strainer shall be finer than specified for final strainers.

3. Sealing/Filtering of Open Ducts: Address that all open ducts shall be either sealed or protected with filter media. Generally return or exhaust systems shall not be used during construction unless otherwise approved.

4. Lubrication and Maintenance: Contractor shall maintain the systems and equipment in accordance with the manufacturer’s instructions. Contractor shall coordinate lubricants used with Owner’s operators. Frequency of lubrication and inspection shall be as recommended by manufacturer’s literature. Applicable maintenance lubrication schedules shall be included in the plan. Draft maintenance logs shall be submitted with plan and completed as maintenance is performed.

5. Operation outside of Normal ranges: Systems and equipment shall not be operated outside the range of specified conditions. Plan shall address how the contractor will ensure that operation will not harm the equipment

6. Emergency Condition Identification and Response protocols: Plan shall address protocols for responding to equipment malfunctions and or harmful operation. Automatic safeties and remote enunciation shall be in place to protect people and property. Temporary operation shall not be allowed until there is a automatic communication/enunciation medium such as a phone connection or an internet connection. At a minimum, an alarm on the equipment used for temporary service shall be automatically sent to the contractor’s 24 hour monitoring service and to the Owner’s help desk. The contractor shall respond to and be responsible for securing conditions within the building. Owner shall assess the situation and as necessary secure utilities feeding the building from isolation points outside of the building.

D. Campus Utility Impact: The plan shall address the expected impact on the campus utilities involved in the temporary conditioning equipment. Specifically address:

1. How the systems will be controlled to both ensure they are operating in range, and to avoid energy waste or inefficient conditions.

2. Project the range of loads and flows to be imposed on the campus systems. For cooling, indicate how you will ensure a temperature split of at least 8 degF.

3. For campus chilled water connections, the bridge connection and automatic control of the bridge related sequences shall be installed, functional and tested.

E. Building Protection: Address how the system will be controlled to avoid humidity conditions that will either promote mold growth or cause corrosion.
F. Equipment Reconditioning: Address with specific means and methods how the equipment used for temporary conditioning will be re-conditioned to new condition. Belts, seals, bearings, couplings, or other parts that wear more than 3% of their expected life shall be replaced.

G. Cleaning: Address how ducts, pipes, coils, converters, air handling equipment, terminal units, etc. shall be cleaned at final turn over.

H. Operations Log: Contractor responsible for operating the equipment shall maintain a log of all activities associated with operating and maintaining equipment. Log shall be submitted to Owner on a frequency specified by them.

I. Operating System Alterations: Plan shall address specific protocol for doing work the systems

J. Any material, device, component, equipment, etc. that is assessed as damaged or as having a substantially shortened life as a result of temporary conditioning operation shall be replaced by the contractor at no cost to the contract.

K. Segregation: Where only portions of a system are to be used, contractor shall specifically indicate how the used portion will be isolated from the unused portion. Plan shall address how to ensure that the reduced operation condition will be maintained within acceptable ranges, and/or how capacity will be throttled to keep all operating parameters in recommended ranges.

PART II. PRODUCTS

2.1 INSTRUMENTATION

A. General: All testing equipment used in the commissioning process shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. All equipment shall be calibrated according to the manufacturer’s recommended intervals. Calibration tags shall be affixed or certificates readily available.

B. Standard Testing Instrumentation: Standard testing instrumentation normally used for performance assessment and diagnosis will be provided by the subcontractor or CA at the discretion of the CA.

C. Special Tools: Special equipment, tools and instruments (only available from a vendor, and specific to a piece of equipment) that are required for testing equipment in accordance with these Contract Documents shall be included in the base bid price to the Contractor and left on site for the Owner.

PART III. EXECUTION

3.1 START-UP STANDARD OF CARE

A. Procedures that establish a minimum Standard-of-Care for the start-up, check out and testing of applicable equipment are specified in the individual technical specifications as well as Section 230810. Contractor shall apply this Standard-of-Care and document per the Cx requirements.

3.2 FUNCTIONAL PERFORMANCE TEST EXECUTION

A. Functional Performance Testing procedures are specified in Section 01810. Contractor shall participate in the development and approval of the testing procedures, as well as participate as required in the initial sample of tests as indicated herein.

3.3 ACTION LIST
A. CXA shall maintain an Action List tracking Action Items (required information, identified deficiencies, work required, etc.) that relate to Cx. Each item shall be tracked with the initiator, the parties responsible, due date, the date of closure, and a description of the resolution. Each item shall be categorized for sorting and tracking and for documentation on applicable forms.

B. CXA will disseminate this list as appropriate to keep all parties informed.

C. All parties indicated as responsible for an action item shall respond. All Parties shall respond through the Project Portal or by responding to the Action Item e-mail sent by the CA.

D. The originator of an Action Item shall close it and record the resolution. Closing an Action Item amounts to entering the date on which it was addressed.

END OF SECTION 01 91 13
PART I. GENERAL

1.1 WORK INCLUDED
   A. Functional Performance Testing of systems.
   B. Documentation of FPTs.
   C. Acceptance criteria.

1.2 SCOPE
   A. This section describes the Functional Performance Testing (FPT) process, procedures, and requirements. It is intended to illustrate (i) the Contractor’s requirements for assisting the Commissioning Authority (CA) with the functional performance testing of systems.
   B. The CA will prepare itemized and detailed testing plans and procedures that:
      1. Specify individual tests and procedures that meet the general requirements of the Cx Plan and commissioning process;
      2. Serve to document and record the testing procedures and the results of the tests.
   C. The Contractor shall review the proposed FPTs to ensure the feasibility, safety, equipment and warranty protection, and scope.

1.3 RELATED WORK AND DOCUMENTS
   A. Section 019113: Specifies the general facility commissioning procedures common across all Divisions and the Contractor’s responsibilities for the commissioning process.
   B. Section 230810 – Mechanical Systems Commissioning: Details the commissioning procedures specific to Division 15 work.
   C. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.

1.4 DEFINITIONS AND ABBREVIATIONS
   A. Refer to Section 019113.

1.5 FUNCTIONAL PERFORMANCE TESTING
   A. Objectives and Scope: Each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested
      1. Normal Operation: In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. These series of tests will demonstrate that the systems and equipment operate throughout typical operation including normal adjusting, cleaning, media replacement, and maintenance.
2. Abnormal Operation: Test each system to simulate possible abnormal conditions and verify proper responses to such modes and conditions as power failure, equipment and component failure, freeze condition, deviation of operating parameters outside of normal, no flow, supporting utility failure, human error, etc.. This series shall demonstrate proper and safe response to the focus systems and the other systems that it affects or integrates with. These test shall also demonstrate proper enunciation of abnormal conditions to quickly and effectively notify users and operators of such condition. Specific modes required in this project are given in this section and any other sections where test requirements are found.

B. Development of Test Procedures. CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Prior to execution, the CA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, equipment and warranty protection, and scope. The CA will also submit the tests to the A/E for review.

1. Contractor shall review the FPTs in detail and approve them.

2. The CA shall review Owner-contracted testing, factory testing, or required Owner acceptance tests for which the CA is not responsible to oversee. Review shall include content, scope, and documentation format, and shall determine what further testing or format changes may be required. Redundancy of testing shall be minimized.

3. The purpose of any given specific FPT is to verify and document compliance with the stated criteria of acceptance.

C. Scheduling: After Contractors notification that systems are ready for testing and submittal and review of all the required submittals has occurred, CM shall schedule the testing. To the extent practical, tests shall be scheduled to allow efficient and contiguous testing of inter-related systems and equipment.

D. Phasing: Non-interdependent segments of the project testing can be phased. Phasing of this project is described below.

E. Participation: CA will direct and conduct functional performance tests after Start-Up Procedure documentation of systems and equipment has been reviewed and accepted. Conceptual procedures for the functional performance testing are outlined elsewhere in this Section. The testing involves all parties including the Contractors, but is generally executed by the CA. The intention is to work the initial, unique, systems with the contractors and complete the remaining tests without contractor involvement. As such, the following paragraphs define the level of Contractor involvement required for FPT support. This time allotment for FPT support does not include the time for ATC system Demonstration, repairs of any deficiencies, retesting as a result of failed testing, or any of the pre-functional start-up tests required within the specifications. This does not include the requirements for Off-Season testing.

1. Typically, multiple parties are required for any given test, yet participation for any given party is only required for the respective portion of the test for which the party is responsible. The CA will notify each trade of the testing which they must participate. Only those notified Contractors, which participate in the testing, will be credited for the hours against their FPT allotment.

2. No party involved with the project is prohibited from participation in or witnessing of any tests. Any contractor may elect to witness all tests on their systems even if their involvement is not directly requested by the CA. In these instances the time used by the Contractor is not part of the FPT allotted hours.

3. The maximum required time for contractor FPT participation (in hours) is indicated below, by trade. Each category of support is to be provided by the contractor responsible for the installation of the system (e.g., the fire alarm support is to be provided by the FAC). Additional time required by the Contractor due to incompleteness of the system, failure of tests, or failure of sampling criteria shall be at the contractors expense, with no additional costs to the Owner.
a) Mechanical (HVAC) FPT Support – 16 hours per campus
b) Mechanical (Plumbing) FPT Support – 16 hours per campus
c) Building Automation System FPT Support – 40 hours per campus
d) TAB FPT Support – 16 hours per campus

4. The CA will track the Contractor’s FPT participation based on 4-hour segments of work, except as noted below.

5. Contractor assumes responsibility for damage to systems conducted in accordance with the approved procedures.

F. **Detailed Test Procedures and Contractor Review**: CA will prepare detailed and itemized testing procedures to define and document the FPT. These will be developed during the Construction Phase and completed during the Acceptance Phase. The CA shall submit these procedures to the Contractor for review. Contractor shall indicate all required limitations, safety procedures, maximum thresholds, and any other parameters during the FPT development. Contract shall be responsible for any damage to the equipment caused by functional performance testing done per the procedures and within the limitations of the approved procedures.

G. **Completeness**: All systems must be completed and ready for FPT. All start up, factory authorized field testing, independent testing agency tests, and TAB procedures must be complete and the control systems must be tested and started for the respective system or component.

H. **Test Documentation**: CA will conduct tests, and/or witness tests as applicable. CA will record all test results on the forms developed for the testing. CA will ‘Pass’ or ‘Fail’ the testing and record the date and time of the test. Deficiencies shall clearly be indicated when the test is failed. When all related testing is completed successfully, CA shall recommend acceptance of the system or component.

I. **Deficiencies and Re-Testing**: When deficiencies are identified during testing, depending on their extent or magnitude, they can be corrected during the test and the testing can continue to successful completion. More significant deficiencies will require failure of the test and re-testing. Deficiencies of this magnitude will result in an Action Item on the Action List. The resolution of the deficiency will then subsequently be tracked by the CA via the Action List. All tests shall be repeated until successful completion. Refer to more specific provisions below.

J. **Sampling**: Some types of identical equipment (such as terminal devices) will be tested using a sampling strategy. The sample percentage is indicated in the generic FPT provided elsewhere in this Section.

K. **Max Failure Limit and Sample Percentages**: A Maximum Failure Limit is indicated along with the Sampling Percentages. The Max Failure Limit indicates the maximum percentage of the tested devices that may have any test that fails before an entirely new sample must be tested. This is based on the concept that if many failures occur, it is a result of inadequate start-up or check out by the Contractor. When the maximum number of failures is reached, testing on that sample will be terminated and re-testing will be scheduled.

1. If no Max Failure Limit is indicated, all tested samples must pass (Max Failure Limit 0%).
2. Where sample tests involve multiple systems (i.e., checking strainers on different hydronic systems) the Maximum Failure Limit will apply per system.
3. The responsible Contractors shall pay the CA cost of that sample test, and redo the start-up/TAB for the applicable devices/systems.
4. All work necessitated by sample failures shall be at no cost to the Owner.

L. **Opposite Season Testing**: Testing procedures shall be repeated and/or conducted as necessary during appropriate seasons. Opposite Season testing will be required where scheduling prohibits thorough testing in all modes of operation. Air handler and central heating system testing for heating-related modes of operation and control loops shall be tested during outside air
temperatures below 45°F or above 80°F depending upon the weather experienced during FPTs. The MC, ATC, and TAB contractors shall allow one, eight-hour day for Opposite-Season testing.

M. Approval: The CA passes each test and subsequently recommends approval to Owner or CM who reviews and approves the FPT.

1.6 COORDINATION BETWEEN TESTING PARTIES.

A. Factory Start-Ups: For many systems and equipment, Factory Start-Ups are specified. These Factory Start-Ups will be reviewed and checked during functional performance testing. All costs associated with the Factory Start-Ups are included with the bid unless otherwise noted. In general, Contractor shall make notification of when Factory Start-Ups are occurring and coordinate these with witnessing Parties. The CA and CxT members may witness Factory Start-Ups at their discretion. Aspects of functional performance testing accomplished during the Factory Start-Ups may be accomplished and approved by the CA if they meet the intent of the FPT. Time used by the various Contractors during factory start-ups does not count towards the FPT support allotted hours.

B. Independent Testing Agencies: For systems where Independent Testing Agencies are specified, the cost of this testing is included with the bid unless otherwise noted. Much of the testing performed by these independent agencies will cover aspects required in the Start-Up Procedures and functional performance tests. Time used by the various Contractors during Independent Testing Agency testing does not count towards the FPT support allotted hours.

1. Contractor and testing agencies shall coordinate with the CA so that the CA can witness the testing and approve the applicable aspects of the FPTs.

2. The CA may in some cases independently spot-check work of the testing agencies if the tests were not witnessed. However, it is not the intent for the CA to re-accomplish testing by others that is specified in the construction specifications. For instance, much of the testing requirements for the electrical systems will be performed by the independent electrical testing agency provided under the bid. The CA shall witness the indicated sample of the testing and record the results in the record of functional performance tests.

3. Contractor is responsible for coordinating the efforts of testing agency with that of the Cx process. Documentation shall be contiguous and seamless and duplication should be avoided. Testing agencies shall complete the documentation of the Cx process as required.

C. Specialized Testing by Contractor: Where specialized testing is specified in the technical specifications, Contractor, subcontractor, vendor, or factory representative as applicable shall conduct the specified testing and provide all specialized instrumentation and equipment. CA and other CxT members may witness tests at their discretion. The CA may in some cases independently spot-check the results of the tests if the tests were not witnessed. However, it is not the intent for the CA to re-accomplish testing that is specified in the construction specifications. All specialized testing procedures shall be integrated with the Cx process and all documentation shall be coordinated and integrated with the documentation of the Cx process. Time used by the various Contractors for specialized testing does not count towards the FPT support allotted hours. Examples of specialized testing (not necessarily contained in this project) include:

1. Generator load testing (not building power outage functional testing which will be administered by CA)
2. Acceptance testing of the Fire Alarm System
3. Water purity tests on a RO/DI system
4. Fire suppression system hydraulic tests
5. Laboratory Gas Cross Connection testing
6. Electrical System Testing per NETA
7. Liquid Waste Decontamination System
8. Chemical Shower System
9. Clean Room Certification tests.

1.7 FPT ACCEPTANCE CRITERIA

A. The Acceptance Criteria shall be as follows unless more specifically indicated within individual tests. CA may exercise professional judgment to relax requirements and pass tests and recommend approval when appropriate.

1. Capacity and/or equipment performance will generally be as specified ±5%.
2. Efficiency where specifically indicated in the documents will be ±5%. When inferred from manufacturer’s catalogue data, criteria will be ±10%.
3. Balancing-related criteria will be ±5% for water and ±10% for air.
4. Accuracy/repeatability on sensing devices will be as specified for the device. CA and TAB will use calibrated gages for independent validation and use judgment in passing or failing the devices. In many cases, the coordination of multiple related sensors is more important than absolute accuracy.
5. Loop response will not include any oscillations and setpoint deviation shall be reasonable for the control loop as judged by the CA.
6. HVAC sequence-related criteria will be as explicitly specified in the documents and as interpreted by the CA. Code required sequencing shall be per the applicable code.
7. System sequences shall be as required by the approved shop drawings.
8. Motor Phase Imbalance: Shall be no more than 2% (Amps and Volts)
9. Indoor Environmental Parameters (T, RH, CO₂, VOC): Shall be as indicated in the Basis of Design document. Otherwise, as recommended in the most current version of the ASHRAE Handbooks for the applicable occupancy.
10. Air Pressurization: As indicated in the Basis of Design document. Otherwise, as indicated in the most current version of the ASHRAE Handbooks for the applicable occupancy. Smoke/shaft pressurization shall be as required by NFPA to maintain maximum door opening forces and to restrict the passage of smoke.
11. Indoor Lighting Levels: As indicated in the Basis of Design document. Otherwise, as recommended in the most current version of the IES Handbooks for the applicable occupancy.
13. Inter-system interfaces and coordination: as specified and generally to ensure safe, reliable, and robust operation.

PART II. PRODUCTS

2.1 INSTRUMENTATION

A. General: All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. All equipment shall be calibrated according to the manufacturer’s recommended intervals. Calibration tags shall be affixed or certificates readily available. Supplier of instrumentation shall submit the calibration certificates along with the start-up documentation.

B. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and provided to the Owner.
PART III. FUNCTIONAL PERFORMANCE TESTS (SYSTEMS AND EQUIPMENT RELATED)

3.1 PREREQUISITES

A. All equipment, components, and devices applicable to the FPT must be started and the Start-Up must be documented and passed. This includes completion of Start-Up Procedures, pressure testing of equipment, duct, piping; flushing/cleaning of applicable systems; completed labeling and identification; completed insulation of applicable systems; and all other requirements for placing system into dynamic operation. TAB work must also be complete for the system being tested.

B. Unless specifically agreed to by the Owner and CA, all support systems shall be complete prior to FPT. For instance, an air handler will require that:
   1. The electrical system serving it is completed and tested;
   2. The hydronic systems serving it have been pressure tested, flushed, and functional performance tested;
   3. Balancing has been accomplished on the air and water sides;
   4. The control systems have been started and calibrated.

C. The CA shall determine the optimal sequence of testing.

3.2 FUNCTIONAL TESTING PROCESS

A. Functional Testing on any given system shall generally begin with testing device level elements; progress to component level; to system level, to inter-system level to building level.

B. Functional Testing of systems shall generally proceed from the utilities to the central systems, to the distribution systems, to the zone terminal units and services. CA shall plan this process and communicate it through a precedent diagram (in Excel format). Construction Manager shall reflect that process in the Construction Schedule. Subcontractors shall perform work in accordance with the schedule.

C. The project specific FPTs will be distributed to all parties during the construction phase of the project.

END OF SECTION 01 91 16
SECTION 02 81 00
HAZARDOUS MATERIALS REMEDIATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Drawings including, but not limited to Architectural, Structural, & MEP drawings

C. Asbestos & Lead Survey – Roof, 500 Court Street, Martinez, CA; prepared by Vista Environmental Consulting and dated July 18, 2018; Survey of roof, roof level equipment, and roof access only.

D. Asbestos & Lead Survey, 500 Court Street, Martinez, CA; prepared by Vista Environmental Consulting and dated August 1, 2018. Survey of building excluding the roof and roof level.

1.2 SUMMARY

A. This Section includes the following:

1. A general description of the hazardous materials related work associated with this project and including information regarding known and assumed (presumed) existing hazardous materials likely to be impacted and abated by this project.

2. Requirements and procedures related to asbestos abatement prior to building retrofit & remodel work.

3. Requirements and procedures related to lead-related selective demolition work.

4. Requirements for removal and disposal of universal waste items, smoke detectors, and equipment with ozone depleting refrigerant gasses (CFCs, Freon) if they are impacted prior to selective demolition.

B. Existing Hazardous Materials Conditions.

1. The Contractor shall take into account the known and presumed existing asbestos, lead-containing materials, and other hazardous materials known or assumed present based on existing survey reports provided by the Contra Costa Community College District (CCCCCD) and contract documents.

2. The Contractor’s work requires removal and/or disturbance of hazardous materials such as asbestos, lead containing paints, universal wastes (UW), and other hazardous materials. All associated costs of hazardous material remediation, worker protection, clean up and disposal are to be included in the bid price submitted.

3. Hazardous Materials known or assumed to be present in the CCCCCD District Office Building to be retrofitted and remodeled with approximate total asbestos quantities present included in the below listing. Actual location and extent of material to be removed shall be coordinated with project drawings including architectural, structural, and MEP:

Contra Costa Community College District
District Office Retrofit Project
a. Asbestos-Containing Materials:

1) Wallboard (gypsum) with ACM joint compound (2% asbestos) as wall & ceiling, and soffit finishes where occurs including: First Floor (Rooms 101, 104, 105, 106, &107), 3rd, 4th, 5th & 6th Floors (throughout), Roof Stairwell, and where occurs; Friable Regulated ACM (RACM); Approximately 45,000 Square Feet (SF) are present.

2) Vinyl Floor Tile (VFT), brown, beige with brown streaks, 12”x12” (2% asbestos) with black mastic (2% asbestos), First Floor, Room 106; Category I Non-Friable ACM; Approximately 834 SF are present.

3) Fire Door Insulation (10% asbestos), First Floor Room 106 and 2nd thru 6th floors at East Stairwell; Friable RACM; Approximately 248 SF are present.

4) Sink Undercoat, white ((2% asbestos), 6th Floor Room 608; Category II Non-Friable ACM; approximately 5 SF are present.

5) Firestop, yellow (2% asbestos), 6th floor and where occurs in building; Category II Non-Friable ACM; Approximately 5 SF are present.

6) Mirror mastic (assumed ACM), all Toilet Room walls; Category II Non-Friable ACM; Approximately 180 SF are present (assumed).

7) Black Mastic between metal frame and concrete (2% asbestos), Fifth Floor and where occurs; Category I Non-Friable ACM; Approximately 40 Linear Feet (LF) are present.

8) Residual Floor Mastic, black, (5% asbestos) on concrete slab under paint in janitor closets; Category I Non-Friable ACM; Approximately 268 SF are present.

9) Flange gaskets, black (5% asbestos), on chilled water system piping flanges; Category I Non-Friable ACM; Approximately 36 SF are present.

10) Valve Packing, concealed (Assumed ACM), mechanical Room Chilled Water piping valves, Mechanical Room; Category II Non-friable ACM; Approximately 1 SF is present.

11) Pipe insulation, DHW, Concealed, (Assumed ACM), RACM, assumed concealed ACM pipe insulation in toilet room walls and ceiling, refer to Plumbing for location and extent.

12) Samples of interior suspect ACM reporting no asbestos detected: Texture coat; carpet mastic (yellow); 12” acoustic ceiling tile & mastic; 4’x4’ & 2’x4’ and 2’x2’ acoustical ceiling panels; VFT (beige) & yellow mastic; Patio floor coating, brown; exterior brown paint, grey concrete paint; concrete wall and ceiling; Cove base 4” black, tan, dark brown, brown with mastics (brown, yellow, white, dark brown); 6” brown base cove with brown mastic; Ceramic tile grout, & mortar; wallpapers (four types); VFT (grey) and black mastic; yellow floor stanchion mastic; patio hand rail coating, grey; window sealant, white; yellow mastic with blue entry sheet flooring; terrazzo sink basins; exposed pipe and pipe hanger jacket and insulation (white/yellow) on 9” pipe; HVAC duct sealant, grey; HVAC duct tape & sealant (white & grey), black sealant on HVAC; Valve insulation at Expansion Tank; Stair tread mastic, yellow; white wall sealant; black concrete floor coating: & brown
sealant on door and concrete wall. At the roof levels, samples reporting no asbestos detected included: Painted stucco; concrete wall; grey and black penetration mastics, gaskets green and gray on mechanical piping; duct sealant white; grey and white sealant/tape, built-up roofing field; parapet base; roof drain paint and mastic; flex connectors; insulation on exposed 10” piping valves & hangers; and paint/sealant (grey/tan) on duct seams. Refer to referenced survey reports for more specific information including sample locations.

13) Report any new or different suspect ACM to the Owner or Owners Representative upon discovery to allow for evaluation prior to disturbing any unknown suspect asbestos material.

b. Lead-Containing Paints (LCP) and Lead-Containing Coatings - All paints untested paints shall be considered lead-containing paint (LCP) with detectable levels of lead and for pre-1978 construction shall be considered to be lead-based paint (LBP) unless proven otherwise. Existing survey results by XRF indicates LBP and lower levels of lead were detected as follows:

1) All ceramic wall tile glazes (blue, yellow, white, light blue) ranged from 6.9-10.1 mg/cm² lead. Note: All ceramic floor tile glazes were low lead (0.01 mg/cm²)
2) White painted drywall (interior walls, soffits, ceilings) ranged from 0.04 – 1.2 mg/cm².
3) All other interior building components tested were typically far less than 1.0 mg/cm². These included metal door frames, metal hand rails, painted pipe, metal doors, and floor & concrete slab coatings.
4) Roof level test results detected LBP (0.98% lead) on red painted pipe but all remaining paint chip results for metal duct, fan housing, door and AHU unit ranged from 0.028-0.35% lead.

c. Coolant Gasses (e.g. CFC’s): Equipment with regulated coolant gasses may be in equipment to be demolished. Coolant gasses associated with HVAC and refrigerant type equipment are assumed to contain ozone depleting Freon type requiring recycling.

d. Smoke Detectors: Smoke detectors, if demolished, must be assumed to contain radioactive material sources requiring special handling and disposal procedures pending verification inspection upon removal.

e. Review the reference hazardous materials survey reports for more specific information regarding hazardous materials. The Contractor shall carefully review all project drawings and reference information to identify impacted hazardous materials including location and extent of each type of regulated material to be impacted by the project. The actual location and extent is to be field verified by the Contractor prior to submitting a bid.

C. Summary of Hazardous Materials-Related Work

1. The work of this project involves removing all impacted asbestos-containing materials and other identified hazardous materials prior to selective demolition and all required cutting and patching activities both indicated and inferred by the project plans. This work scope also includes removal of other hazardous materials when impacted by selective demolition including any Universal Waste Items, regulated coolant gases from HVAC equipment,
smoke detectors with potential radioactive material ionization sources. The Contractor is responsible for identifying the location and extent of remediation required to complete the project in coordination with project plans and this specification.

2. Asbestos removal work includes but is not limited to the following:
   a. Removal of gypsum wallboard systems with ACM joint compound to the extent required to complete the architectural, structural, plumbing, mechanical & electrical retrofit and remodel work of the project. Refer to drawings for demolition indicated and inferred by work of project including cutting and patching for MEP work. Contractor’s work includes but is no limited to: Removal of wallboard finishes of walls, wall sections, soffits, ceiling finishes acoustical tile backing, and ceramic wall tile backing per demolition plans and where inferred as needed to complete the project work.
   b. Removal of Presumed ACM insulation on concealed piping demolished or disturbed by Plumbing and Mechanical work and any assumed ACM associated with pipe flange gaskets and valve packing.
   c. Fire Doors with ACM cores at locations of fire door demolition including the East Stairwell entrances at each level.
   d. Removal of assumed ACM mirror mastic at toilet room locations of wall finish demolition.
   e. Other identified ACM building components and finishes listed above (sinks, resilient floor and flooring mastics, fire stop compounds, and caulking materials) when impacted by the project work. Otherwise, protect ACM to remain.

3. The selective demolition of this project also involves disturbing lead in the paints and coatings to complete the project work. Includes but is not limited to removal of ceramic wall tiles with high lead content, some wall finishes and mechanical components. The Contractor is responsible for proper removal and disposal of all hazardous waste generated by this project and is responsible for completing all work without adding to site or building contamination above background level prior to the start of work.

4. The Contractor shall review all available all project selective demolition and retrofit/remodel constructions plans for the building associated with this project and coordinate the hazardous materials work with those plans and the information they provide.

5. This project will require Contractor personnel qualified to conduct asbestos –related work primarily of OSHA Class II ACM removal work and lead-related construction/selective demolition work. The project may require removal and proper disposal of various Universal Wastes, Smoke Detectors and Coolant Gasses. Review the referenced hazardous material survey reports and project drawings in detail to verify the location and approximate extent of hazardous materials-impacted work and include the cost of that work in the project bid price.

6. All hazardous materials disturbance and removal work shall be undertaken utilizing the proper asbestos, lead and hazardous materials work practices, protective measures, controls, waste stream profiling and testing, and waste disposal of properly characterized removed materials as required to support this project:
a. Removed friable asbestos wastes are to be disposed of as hazardous waste;
b. Removed non-friable ACM wastes and wallboard/ACM joint compound systems (if shown to be <1% asbestos as point counted composite) shall be manifested and disposed of as non-hazardous asbestos wastes;
c. Universal Wastes shall be disposed of as hazardous waste or recycled by a permitted TSD.
d. Coolant gasses must be reclaimed and recycled in accordance with federal and state regulation.
e. Smoke detectors with radioactive sources must be properly disposed of per regulation.

7. The Contractor’s work scope all required lead-related protective measures for Cal/OSHA and Cal/EPA compliance associated with selective demolition and other finish disturbing activities of this project.

8. Conduct removal existing asbestos-containing materials and disturbance of lead-containing paints and coating in compliance with Cal/OSHA worker protection rules and this section.

9. Clean up all surfaces affected by selective demolition so as to leave each work area and the building with lead levels below all recognized hazard thresholds at the end of each day’s work shift and prior to any new construction.

D. Owner’s Observation Service

1. The Owner will retain the services of a qualified industrial hygiene consultant certified for asbestos and lead consulting in the State of California, for the purpose of monitoring the day to day operations of the Contractor on an ongoing or as needed basis to ensure each work area is completed before it is released for unrestricted access by the Owner or others. This consultant shall be referred to as the Owner’s Observation Service (Observation Service) and shall have authority to review the Contractor’s pre-start, progress, and close out submittals; inspect containments, observe Contractor’s procedural compliance, review Work Areas for completion, and conduct clearance inspection and testing with regard to asbestos and, where appropriate, other hazardous material removals and lead-related demolition.

2. The Contractor is obligated to provide notification to the Observation Service at least 48 hours in advance of starting site work the will disturb asbestos-containing materials to allow for startup inspection and 48 hours prior to any final clearance inspection and testing. Any delay caused by the failure to give proper notification to the Observation Service shall be at no cost to the Owner.

1.3 REFERENCES:

A. General: Codes, regulations, and references to hazardous materials abatement work include, but are not limited to the most current versions of the following:

1. California Code of Regulations (CCR):

   Title 8; Article 2.5 Registration Asbestos-Related Work
   Title 8, Section 1529 Construction Safety Orders, Asbestos Regulations
   Title 8, Section 1531 Construction Safety Orders, Respiratory Protection
Title 8, Section 1532.1  Construction Safety Orders, Lead in Construction
Title 17, Div. 1, Ch. 8  Accreditation, Certification, and Work Practices for Lead-Based Paint and Lead Hazards
Title 22, Div. 4.5  Environmental Health Standards for the Management of Hazardous Waste

2. California Health and Safety Code, Division 20, Chapter 6.5, Section 25143.2 (d)(7), (e), & (f) and sections 25143.9 & 25143.10 – regarding the recycling of CFC or HCFC gases.

   a. 40 CFR Part 82 Protection of Stratospheric Ozone: Supplemental Rule Regarding a Recycling Standard Under Section 608 of the Clean Air Act; Final Rule
   b. 40 CFR Part 61 USEPA NESHAPS Rule
   c. 40 CFR Part 745 Lead; Identification of Dangerous Levels of Lead
   d. 40 CFR Part 761, PCB’s Manufacturing, Processing, Distribution, in Commerce, and use Prohibitions
   e. 40 CFR Part 763 USEPA AHERA Asbestos-Containing Materials In School; Final Rule and Notice

4. Regional Air Quality Management District or Air Pollution Control District rules:
   a. Bay Area Air Quality Management District (BAAQMD), Regulation 2, Rule 11

1.4 DEFINITIONS

A. Definitions Specific to Work of this Section.

1. Abatement – Procedures to control airborne contaminate s and other releases from hazardous material-containing building materials. Includes removal, repair, encapsulation, and enclosure as well as proper packaging, transportation and disposal of removed hazardous materials.

2. Aggressive Method – removal of building materials by sanding, abrading, grinding, or other methods that causes intact ACM to become friable.

3. Airlock – A system for permitting ingress and egress with minimum air movement between a contaminated area and an uncontaminated area.

4. Air Monitoring – The processing of measuring the air contaminants such as asbestos or lead for measured volume of air collected over the specific period of time being monitored.

5. Amended Water – A water to which a suitable surfactant has been added in accordance with the manufacturer’s instructions for the surfactant product.

6. Asbestos – The term asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

7. Asbestos Containing Construction Material (ACCM) – Any construction material with an asbestos content of 0.1 percent or greater by weight.

8. Asbestos Containing Material (ACM) – Any material which contains over one percent asbestos as determined by current EPA bulk sample analysis method.

9. Asbestos Fibers – This expression refers to asbestos fibers longer than five micrometers with an aspect ratio of 3:1 or larger under phase contrast microscopy (PCM) analytical procedures.
10. Authorized Visitor – Any Owner Representative, Consultant or Agent and any representative of a regulatory of other agency having jurisdiction over the project and who meets regulatory requirements for entry including training, medical, and proper personal protective equipment use.

11. Class I Asbestos Removal – Class I Asbestos work means activities involving the removal of known or presumed thermal system insulation (TSI) ACM and surfacing ACM.

12. Class II Asbestos Work – Class II Asbestos Work means activities associated with removal of any ACM that is not a Class I surfacing material or thermal system insulation. This includes but is not limited to, removal of resilient flooring materials, roofing materials, asbestos cement products, sealants, caulking materials as well as other ACM’s.

13. Class III Asbestos Work – For this project-small scale removal work incidental to support removal or installation of equipment and devices where not intentional asbestos abatement work or removal is involved and the quantity of asbestos waste can be contained in one standard waste bag or glove bag with dimension no greater than 60" by 60" (60 inches square).

14. Class IV Asbestos Work- work by maintenance and custodial workers that requires contact with ACM but for this section does not involve activities that required disturbance of ACM in a manner that could result in airborne asbestos fiber exposure to the workers.

15. Clean Room – An uncontaminated area or room that is a part of the worker decontamination enclosure with provisions for storage of Workers’ street clothes and uncontaminated protective equipment and other uncontaminated materials and equipment.

16. Competent Person – An individual who is capable of identifying asbestos or lead hazards in the workplace and who has sufficient experience and authority to take prompt corrective measures to eliminate them. The Competent Person is required to have been specially trained for the type and level of work to be conducted. The Competent Person is responsible for conducting all required set/containment, in process, completion, and pre-clearance inspections as specified subject to verification and approval by the Owner’s Consultant.”

17. Coolant gasses – Refrigerant gasses that are known or suspected to contain regulated chlorofluorocarbon (CFC) or HCFC gasses whose release to the atmosphere is prohibited and that required special equipment and EPA certified refrigerant reclaimer personnel to safely and properly remove the gas for recycling or destruction at a permitted facility so that the remaining equipment to be demolished or removed can be disposed of in accordance with regulation.

18. Critical Barrier – A unit of temporary construction of air-tight and impermeable barrier which provides effective separation between a contained asbestos Work Area and an adjacent, potentially occupied area. Typically consists of at least two layers of plastic sealed to prevent fiber migration into a non-involved adjacent area.

19. Decontamination Enclosure System (Decon Unit) – A series of connected rooms, with air lock doorways between any two adjacent rooms, for the decontamination of Workers and of materials and equipment. The decontamination enclosure system includes an Equipment Room, Shower Room, and Clean Room and must be contiguous to the Work Area Containment. Alternative systems including remote Decon Units and/or showers require prior approval.
20. Differential Pressure Equipment – A portable local exhaust system equipped with HEPA filtration and capable of maintaining a constant, low velocity air flow into contaminated area from adjacent uncontaminated areas. Also referred to as HEPA Exhaust Units, Negative Air Machines (NAM’s) or Negative Pressure Units (NPU’s). This equipment must meet the HEPA filter efficiency as an installed system, typically by on-site testing prior to use.

21. Disturbance – contact with asbestos-containing construction materials that disrupt their matrix (e.g. render friable) and create visible dust or debris and potential airborne fiber exposure.

22. Encapsulant (sealant) – A liquid material which can be applied to asbestos-containing material or surface and which controls the possible release of asbestos fiber from the material or surface by creating a membrane over the surface (bridging encapsulant), or by penetrating into the material and binding its components together (penetrating encapsulant), or by locking down invisible fibers (lockdown encapsulant).

23. Equipment Room – a contaminated room in the Decon Unit for decontamination of PPE and equipment prior to entering the shower room or area. The Equipment Room or area is supplied with impermeable waste bags or containers for the disposal of contaminated PPE and equipment.

24. Fluorescent Light Ballast (FLB) -- A device that electrically controls fluorescent light fixtures. Most existing FLBs include a capacitor containing 0.1 kilograms or less of a dielectric fluid that may contain PCBs if the ballast was manufactured prior to 1979. More recently, electronic ballasts that do not contain PCBs have come into use. Pre-1979 ballasts may also contain asphalt potting compounds that also contain PCB.

25. Fluorescent Lamp or Tube – A low pressure electric discharge lamp that generates ultraviolet light radiation by the passage of an arc through mercury vapor; the inner surface of the lamp or tube is coated with a phosphor which absorbs the ultraviolet light and converts some of it to visible light. Spent fluorescent light tubes typically contain mercury in concentrations exceeding the total threshold limit concentration (TTLC) and/or the soluble threshold limit concentration (STLC) making them a presumptive hazardous waste in California. Under current regulation, they are considered a Universal Waste requiring special handling and disposal or recycling.

26. Friable ACM – An ACM that that when dry can be crumbled, pulverized, or reduced to power by hand pressure. A non-friable ACM that has not be rendered friable by mechanical or other means is considered “intact.”

27. Hazardous Materials – Hazardous materials include, but are not limited to: asbestos-containing construction materials, lead and lead-based paint, mercury, PCB, coolant gases, universal wastes, solvents, fuels and other chemical products or wastes.

28. Hazardous Waste – Any waste material that is listed or meets the criteria for hazardous waste as set forth in the California Code of Regulations (CCR), Title 22, Chapter 11.

29. HEPA Filter – A high-efficiency particulate absolute (HEPA) filter capable of trapping and retaining 99.97 percent of particles equal or greater than 0.3 micrometers (micron) in mass median aerodynamic equivalent diameter.

30. HEPA Vacuum Equipment – Vacuuming equipment with a HEPA (UL 586 labeled) filter system. The vacuum must meet the HEPA efficiency of 99.97% efficiency for mono-
dispersed 0.3 micron diameter particle as a system. On site testing may be required to verify the vacuum system meets HEPA requirements.

31. Ionization Technology Smoke Detector – Smoke detectors with radioactive isotope source (Americium 241) for smoke detection. Should be designated as such by an “i” or the word “Ionization” on front or back. Special disposal restriction apply. Photoelectric technology smoke detectors do not have a radioactive material source and are usually designated with a “P” or the word “Photoelectric”.

32. Lead-Based Paint (LBP) – Lead-Containing Paint (LCP) that is at least 0.5% lead by weight or 1.0 milligrams of lead per square centimeter of surface area (as measured by XRF lead analyzer). Note: any untested paints or coatings must be presumed to be LBP for structures constructed prior to 1978 and any other untested paints or paints found to have no detectable lead by XRF testing only must be assumed to contain some detectable lead subject to OSHA regulation.

33. Lead Hazardous Waste – Lead-based paint waste or other debris that has been classified as hazardous due to the characteristic of toxicity, as determined by testing in accordance with the California Code of Regulations, Title 22, Division 4.5. A lead hazardous waste is any substance(s) at concentrations greater than its listed Soluble Threshold Limit Concentration (STLC) or Total Threshold Limit Concentration (TTLC). The STLC for lead is 5.0 parts per million (ppm) and the TTLC for lead is 1000 ppm lead. If either of these values are exceeded, the lead related waste will need to be further characterized by the Toxicity Characteristic Leaching Procedure (TCLP) in accordance with 40 CFR 261 and possibly other tests prior to disposal as a hazardous waste. Waste testing for proper disposal is the responsibility of the Contractor.

34. Lead Paint Surface Preparation – The process of conducting surface preparation on building surfaces and components that a coated with LCP or LBP in order to remove loose, peeling, flaking paint and associated chalking, if present, to prepare surface for paint stabilization, painting or demolition.

35. Mercury – A silvery liquid, metallic element which is toxic by inhalation and skin absorption. Mercury is a poison to the central nervous system and gastrointestinal tract and is considered to be an inorganic persistent and bioaccumulative toxic substance subject to Cal/PPA hazardous waste regulation. Mercury can often be found in various gauges, thermostats, mercury switches, fluorescent and high intensity lamps, and other items or equipment.

36. Negative Pressure Enclosure (NPE) – An enclosed or contained area of any configuration constructed of polyethylene sheeting (6 mil minimum) with a minimum of four (4) air changes per hour and a negative pressure of -0.02 inches of water as compared to surrounding areas outside the enclosure. NPE conditions must be maintained operational until the Work Area passes final clearance inspection and clearance air testing.

37. Non-Friable Asbestos Material – Material that contains asbestos in which the fibers have been locked in by a bonding agent, coating binder, or other material so that the asbestos is well bound and will not release fibers in excess of the asbestos control limit during any appropriate use, handling, demolition, storage, transportation, processing, or disposal.

38. Non-hazardous Asbestos Waste – Wastes which are non-friable and/or are below one percent asbestos by weight as determined by objective testing. Non-friable (intact) ACM
wastes require OSHA Asbestos Hazard warning labels and disposal at landfills that accept such asbestos wastes.

39. Observation Service – Environmental Consultant hired to conduct various construction administration services including but not limited to compliance observation and air monitoring services on behalf of the Owner. Sometimes referred to as the Owner’s Observation Service.

40. Owner – Contra Costa Community College District (CCCCD).

41. Owner’s Representative – Representative(s) that the Owner has assigned to manage, oversee, and inspect this project. This may include an architectural and/or construction management consultant hired by Owner to oversee the project and/or the assigned Construction Inspector.

42. Regulated Area – A Work Area established to demarcate areas where Class I, Class II, Class III is conducted and any other Work Area where airborne asbestos is reasonably likely to exceed the Permissible Exposure Limit (PEL). The Regulated Area must include all adjoining areas where asbestos waste and debris may accumulate. Demarcation must include warning signage and must limit access to authorized and properly trained, medically qualified, and protected personnel.

43. Removal – Procedures necessary to remove hazardous materials such as, but not limited to, asbestos or lead from designated areas and to dispose of these materials at an acceptable properly permitted waste disposal site.

44. Surfactant – An approved chemical wetting agent added to water to improve penetration.

45. Stabilization – Lead Paint Surface Preparation followed by application of at minimum a primer coat and usually followed by finish coating(s).

46. Trigger Task – Operation, process or task type specifically identified in the OSHA or Cal/OSHA lead standard as a potential lead exposure requiring certain protective measures to be implemented prior to obtaining the results of an initial exposure assessment. Trigger Tasks include, but are not limited to, any of the following task types when materials or paints that contain lead are present and will be disturbed:
   a. Manual Demolition;
   b. Manual Scraping or Sanding;
   c. Heat Gun Application;
   d. Use of power tools for cleaning or removal;
   e. Rivet busting;
   f. Abrasive blasting and cleanup of spent abrasive; &
   g. Welding, cutting or torch burning.

47. TSD Facility – An US EPA or State EPA permitted facility for transportation, storage and disposal of hazardous wastes.

48. Unclassified Asbestos Work – work involved in removal or disturbance of construction materials with 1% asbestos or less (e.g. trace asbestos). Worker protection and certain work practices are required for this work.
49. Universal Waste – Certain common designated hazardous wastes that are required to be handled and disposed of or recycled in accordance with special rules. Includes fluorescent light tubes, HID lamps, sodium vapor lamps, mercury switches, mercury thermostats, NiCad, Silver, & Mercury & other batteries (often used in building alarms and emergency systems), and other items.

50. Visually Clean – Free of visible dust, paint chips, dirt, debris, or films removable by vacuuming or wet cleaning methods specified. For outside soil or ground cover areas, visually clean shall mean free of visible construction and paint debris, chips or dust distinguishable from the initial soil or ground conditions (after exterior pre-cleaning).

51. Waste Generator Label – Waste Generator label shall include the Generator’s Name, ID Number, Address, and Waste Manifest Number.

52. Wet Cleaning – The process of eliminating asbestos or lead contamination from building surfaces and objects by using cloths, mops, or other cleaning tools that have been dampened with water or water/detergent solution, and by afterwards disposing of these cleaning tools and materials as contaminated waste.

53. Work Area – Designated rooms, spaces, or areas of the project in which hazardous material removal actions are to be undertaken or which may become contaminated as a result of such removal actions during the process and prior to final clean-up and decontamination. A contained Work Area is a Regulated Work Area that has been sealed and equipped with a Decontamination Enclosure System. Worker Decontamination Enclosure System (Worker Decon) – That portion of a Decontamination Enclosure System designed for controlled passage of workers, and other personnel and authorized visitors, typically consisting of a clean room, a shower room, and an equipment room. No eating, drinking or smoking is allowed in Work Areas.

1.5 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site and properly disposed or recycled.

1.6 SUBMITTALS

A. Requirements are as set forth in Contract for items required to be submitted under this section. Submit the following:

B. Pre-Start Submittals:

1. Submit the following:
   a. Licensing and Registration for Contractor or Subcontractor responsible for removal of hazardous materials. Submit copies of current and valid:
      1) The Contractor’s license and Contractor’s asbestos certificate issued by the California State Contractor’s Licensing Board (CSLB);
      2) C-22 Asbestos Abatement Contractor license and Registration for Asbestos-Related Work from the Division of Occupational Safety and Health in accordance with CCR, Title 8, Article 2.5 of the California Administrative Code for any removal or disturbance involving greater than 100 square feet of ACM.
b. Personnel Qualifications: Personnel documents required per this section shall be organized by individual employee and include the following information:

c. Personnel Training:

1) Competent Person/Supervisor (Asbestos-Class I & II Removal Work): Submit training certificates for Contractor/Supervisor Training by Cal/OSHA accredited provider.

2) Workers (Class I & II Removal Work): Submit training certificates for Asbestos Workers Training by Cal/OSHA accredited provider.

3) All workers and their supervisors performing lead-related construction or other hazardous material (e.g. UW) work shall have proper hazard communication training as appropriate to the associated hazard and have documentation available for examination upon request.

d. Medical Examination:

1) Asbestos-related work: Submit proof that personnel who will be performing asbestos-related work have had medical examinations within the last 12 months in conformance with Title 8 CCR; Section 1529 asbestos, and furnish the results of each exam in the form of the physician's written opinion or approval with regard to worker fitness to wear a respirator and perform asbestos work as applicable;

2) Lead-Related Work: Submit proof of medical surveillance completion for each worker performing a lead-related construction “trigger task” or any work likely to result in an airborne lead exposure greater than the PEL or lead.

e. Respirator fit tests: Submit proof that personnel who will be entering asbestos or lead Regulated Areas have had a qualitative respiratory fit test performed within 12 months from the scheduled completion date of the project.


a. Submit copies of notifications to appropriate government agencies where required, including the following:

1) Cal/OSHA District Office: Submit Temporary Work Site Notification for asbestos removal involving greater than 100 SF of ACCM at least 24 in advance of start of asbestos work providing date and time of commencement of work, location, approximate duration, type of business, and kind of job. Provide a copy to Observation Service in pre-start submittal package.

2) Cal/OSHA District Office: Submit Lead-Work Pre-Job Notification for Lead-Based Paint (LBP) related construction work that includes any Trigger Tasks that will involve removing or disturbing greater than 100 SF or 100 LF of LBP or Lead-Based Coatings including ceramic tile glazes. Submit written notification at least 24 hours in advance of startup of the work. Include contractor name and contact information, address of work location, planned start and estimated end dates, number of workers, type of structure, number of workers, amount of lead containing material to be disturbed, description of work and work practices to be used. Provide a copy to Observation Service in pre-start submittal package.
3) Bay Area Air Quality Management District (BAAQMD): Submit notification of every demolition regardless of presence or absence of RACM and every renovation involving removal of RACM in amounts greater or equal to 100 SF, 100LF or 35 cubic feet. Submit according to AQMD regulation at least ten (10) working days prior to start of work and provided copy to the Observation Service with the Pre-Start Submittal.

4) Submit copies of any agency notification amendments and changes on a timely basis with a copy to the Observation Service concurrently.

3. Respiratory Protection Plan: Submit a written standard operating procedure governing selection, fit-testing, and use of respirators for asbestos, lead, or other airborne toxic material exposure protection.

4. Detailed Work Plan: Submit a detailed work plan proposed for use in complying with the requirements of these specifications and project plans. The detailed work plan shall include, at a minimum, the following information:
   a. Procedures: Job-specific procedures proposed for completing the scope of work outlined herein including: means of controlling and containing dust, preventing fugitive emissions, and controlling worker exposure for lead-related construction/demolition work and all Class I or Class II asbestos removal and clean-up work.

5. Plan for personnel air monitoring required by law by the Contractor for Worker protection. The Plan shall include, but not be limited to the following:
   a. Personnel Air Monitoring conducted in strict accordance with 8 CCR 1529 for asbestos and 8CCR 1532.1 for lead-related work. Include calibration data for the secondary standard to be used for air sampling pump calibration on-site. This data must be within six (6) months of the projected completion of this project;
   b. Name, address, and accreditation and/or certification of laboratory selected by the contractor to analyze air samples;
   c. The plan shall include a commitment by the Contractor to submit copies of laboratory results with information regarding personnel and operation sampled as required by Cal/OSHA to the Observation Service within 24 hours of receipt of results as and no later than 72 hours from date of the exposure monitoring.

6. Product Data: Manufacturers product data for all items required for complete and proper execution of the work, this includes product data for all items listed under Part 2 - Products. Product data shall include manufacturing product data, specifications, samples and application instructions, safety data sheets (SDS), and other pertinent information as necessary.

7. Waste Disposal & Recycling Sites: Submit Name Location, Class, and EPA # for each waste disposal site to be used for any asbestos or lead wastes, PCB ballasts, Universal Wastes, other hazardous wastes or hazardous materials or substances required recycling. Include information on permitted recycling sites or firms to be used for Universal Wastes, metallic lead, and regulated reclaimed refrigerant gasses.

C. Daily Submittals: Within 72 hours following the completion of the first Work Shift for each different operation, the Contractor shall submit the following information to the Observation Service by fax or e-mail:
1. OSHA exposure monitoring sample results for asbestos including Eight (8) hour Time Weighted Average (TWA) sampling and results for asbestos excursion limit samples. Sample results must indicate the person sampled, description of work activity, start and stop times, liters per minute, total volume and laboratory result expressed as an eight-hour TWA or excursion limit sample.

2. OSHA exposure monitoring sample results for 8-hour TWA monitoring of “trigger tasks” associated with lead-related construction/demolition activities.

D. Close-Out Submittals:

1. Within 10 days of completion of all hazardous material removal work, submit a copy of all outstanding Daily Submittals and one copy of each hazardous waste manifest for asbestos, and lead as applicable, each non-hazardous asbestos waste manifest, each Universal Waste manifest, and each refrigerant reclaiming certificate to the Observation Service.

2. Work Area entry/exit logs completed for each asbestos Work Area and each Work Shift.

1.7 Postings

A. Before the commencement of any asbestos or lead related construction work at the site, post Cal/OSHA warning signs in and around the Work Area to comply with Cal/OSHA regulations.

B. Copies of the Contractor’s SCLB license (e.g C-22), Cal/OSHA registration certificate, temporary job-site notifications, pre-start LBP notifications to Cal/OSHA, local agency notifications, emergency exit diagram, emergency phone numbers, Cal/OSHA poster on worker’s rights, and worker’s compensation poster shall be posted proximate to the entrance to each Work Area.

C. The Contractor shall have at least one copy of the Contract Documents including project plans and specifications, and a current copy of 8 CCR 1529 & 1532.1.

PART 2 - PRODUCTS

2.1 GENERAL

A. Submit manufacturer’s product data for all items to be used including the items listed below. Include a SDS for each product as applicable.

B. All materials to be used on the project shall be new in original packages, containers, or bundles bearing the name of the manufacturer and the brand name. Used materials will not be permitted.

2.2 PROTECTIVE COVERING (PLASTIC SHEETING)

A. For standard containment and critical barrier usage: Polyethylene sheets 6 mil and 4 mil in sizes to minimize frequency of joints. Fire retardant polyethylene sheeting, approved and listed by the State Fire Marshall per Section 13121 and/or 13144.1 of the California Health and Safety Code, is required for all renovation projects and all abatement in occupied buildings.
2.3 TAPE, ADHESIVES, SEALANTS

A. Duct tape two inches or wider, or equivalent, capable of sealing joints of adjacent sheets of plastic sheets and for attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions.

B. Spray adhesives for sealing polyethylene to polyethylene shall contain no methylene chloride compounds.

2.4 PROTECTIVE PACKAGING

A. Appropriately labeled 6 mil sealable polyethylene bags as a minimum for asbestos.

B. Bilingual labels (English and Spanish) on waste packages, contaminated material packages and other containers shall be in accordance with EPA or OSHA standards.

2.5 WARNING SIGNS AND LABELS

A. All warning signs and labels must meet all applicable regulatory requirements for wording, size of lettering, and use of language, pictographs, and graphics to effectively convey the warning. Additional requirements apply for hazardous waste containers and shipments for transportation to disposal sites. Asbestos and warning signs are anticipated to be required for this project.

B. Asbestos Warning signs for Regulated Areas must contain the following wording:

```
DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY
WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA
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C. Labels for packaging and containers containing ACM waste (friable and non-friable) must contain the following wording:

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DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATH DUST
AVOID CREATING DUST
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2.6 SURFACTANT

A. Surfactant, or wetting agent, for amending water to ensure asbestos is adequately wet during asbestos removal and subsequent waste handling, packaging/containerizing for disposal. Products such as Fiberlock “Penewet”, Foster 32-90 Asbestos Removal Surfactant, or equivalent products are acceptable for this purpose.

2.7 PERSONAL PROTECTIVE EQUIPMENT

A. Personal Protective Equipment shall comply with the requirements of 29 CFR 1910, Subpart 1 and 8CCR 1514, 1515, 1516, and 1517.

B. Asbestos abatement and lead-related work clothes shall consist of impervious disposable, full-body coveralls, head covers, boots, rubber gloves, and work boots (or sneakers). Sleeves at wrists and cuffs at ankles shall be secure. Disposable coveralls shall be a non-see through type and constructed of DuPont Tyvek, Kimberly-Clark KleenGuard A40 or equivalent fabrics that provide acceptable protection from asbestos and other toxic particulate penetration. Protective clothing for other hazardous must be impervious to those chemical hazards.

C. Eye protection and hard hats shall be available and worn when required by applicable safety regulations.

D. Provide Authorized Visitors with suitable protection clothing, headgear, eye protection, and footwear whenever they enter the Work Area.

2.8 RESPIRATORS

A. Provide all workers, foremen, superintendents, authorized visitors, and inspectors with personally-issued and marked, clean and sanitized respiratory equipment approved by NIOSH. When respirators with disposable filters are employed, provide sufficient filters for replacement as recommended by manufacturers or this specification. Selection of respirators shall be made according to the Cal/OSHA respirator standard and applicable hazard specific regulation.

B. The minimum respiratory protection for asbestos abatement for this project is a half mask respirator as long as the airborne levels do not exceed one tenth of the PEL (e.g. 0.01 f/cc). For other airborne chemical hazards, respirator protection shall selected to ensure protection to below established the Action Level (AL) established by regulation or otherwise 1/2 of the applicable PEL in the absence of an AL.

PART 3 - EXECUTION

3.1 PROJECT PROCEDURES

A. Prior to the start of on-site work, the Contractor shall hold an on-site start-up safety meeting for all of contractor and facility employees that addresses at least the following issues specific for the project:
   1. Safety and health hazards;
   2. Procedures and work practices;
3. Respiratory protection and instruction;
4. Special conditions and/or work requirements.

B. Worker Protection Procedures (Asbestos, Lead, PCB’s, and other hazardous material/substance impacted by project.

C. Provide Authorized Visitors with suitable protective clothing, respirators, headgear, eye protection, and footwear whenever they are required to enter the Work Area. All provided equipment shall be new or in good working condition.

3.2 GENERAL WORK AREA PREPARATION FOR ABATEMENT

A. General Requirements

1. Isolate, effectively protect, or de-energize electrical power to Work Area. Electrical circuits shall be deactivated if they do not include ground fault circuit interrupters.

2. Provide temporary power and lighting and ensure safe installation of temporary power sources and equipment per applicable electrical code requirements and provide ground fault interrupter circuits with power source for electrical equipment to be used.

3. Provide temporary supply of water adequate for wet removal, cleaning, decontamination and operation of employee shower system (where required).

4. Isolate any heating, cooling, ventilation air systems that enter or penetrate the building within or near the Work Area to prevent contamination of other areas of the structure.

5. Cordon off all other accesses to interior Work Areas with barrier tape and warning signage.

6. Seal all remaining openings to interior Work Area, including but not limited to ducts, grills, diffusers, and any other penetrations of the Work Area, with critical barriers consisting of two layers of plastic sheeting sealed with tape.

7. Isolate non-emergency egress doorways, and access ways with temporary barriers and seal with plastic sheeting.

8. Clean and remove movable objects, furniture and equipment.

9. Pre-clean work area using wet cleaning and/or HEPA vacuuming to remove all visible dust and debris prior to starting hazardous material removal or major disturbance work.

10. Cover and seal non-movable objects, furniture and equipment not being abated.

3.3 PREPARATION FOR CLASS I & II ASBESTOS WORK

A. Class I & II Asbestos Removal Work:

1. For Class I and any Class II Removal work that results in creating friable ACM during removal, additional preparation requirements required include:
   a. Install negative pressure enclosure (NPE) containment or negative pressure mini-containments using HEPA filtered exhaust systems ducted to the exterior. HEPA systems must be tested on site prior to use to verify HEPA efficiency is achieved by equipment as installed.
b. Establish a negative pressure differential of at least -.02 inches of water with respect to the exterior of the containment and ensure at least 4 air changes per hour are achieved. The negative pressure shall be monitored using an installed and properly calibrated manometry equipment with a recording strip chart to verify and document compliance. Maintain negative pressure throughout removal and clean-up operation until a successful final clearance has been obtained.

c. Each NPE or mini-containment shall be inspected and smoke tested leaks by the Contractor’s Competent Person in coordination with the Observation Service prior to use. The Observation Service may conduct additional inspection and testing prior to start up.

d. Where glove bags are used, they shall be inside a Regulated Area isolated with critical barriers and used with a drop sheet below for additional protection. Alternatively cover walls, flooring, and other exposed surfaces to remain with at least one layer of plastic sheeting.

e. Install a negative pressure monitoring system for continuous monitoring except were removal is also contained in a glove bag.

f. Install a contiguous three stage decontamination (Decon) unit. Exceptions: for glove bag removals a Decon Area may be set up; mini-containments, if used, shall have at least a two stage decontamination unit; and where a contiguous decontamination unit is not feasible, establish a remote Decon unit on site with a shower and provide a double suiting or re-suiting procedure for egress from the Work Area containment in non-contaminated work clothing.

g. Alternate containment systems and procedures may be used for exterior work (roof, utility trenches, etc.) subject to approval by the Owner’s Observation Service.

3.4 PREPARATION FOR LEAD-PAINT DISTURBANCE WORK

A. In addition to the general preparation requirements (above):

1. Install drop cloth that extends at least five feet beyond area of disturbance to contain and collect resulting lead contaminated paint chips, dust, and debris.

2. Clean and decontaminate Work Area prior to end of shift and place all waste in tightly sealed labeled waste containers.

3. Remove all waste containers and place in secure storage pending disposal.

3.5 ASBESTOS REMOVAL AND DISTURBANCE PROCEDURES

A. Prohibitions. The following methods shall not be used to remove or clean up asbestos:

1. Use of high speed abrasive disc saws without effective HEPA filtered attachments;

2. Compressed air to remove or clean-up asbestos;

3. Dry sweeping or shoveling of asbestos containing dust or debris;

4. Aggressive removal methods where non-aggressive methods are feasible. Where aggressive methods are required, they must include special containment and control procedures acceptable to regulatory agencies and approved by the Observation Service in advance.
B. Gross Removal and Clean-up of ACM (e.g. TSI, Surfacing, and Wallboard with ACM Joint compound).
   1. Use full negative pressure enclosure (NPE) and containment procedures with HEPA exhaust to the building exterior.
   2. Wet ACM to be removed with amended water and continue wetting during removal process.
   3. Place adequately wetted and removed materials promptly in labeled waste disposal bags or containers as it is removed. For wallboard systems see 3.6 B. below.
   4. Close and seal bags and containers as they are filled. Plastic waste bags are to be sealed using the “goose neck” technique by twisting the neck of the bag, bending it over, and taping it with multiple wraps of tape.
   5. Clean exterior bags surfaces by wet wiping and double bag asbestos waste in the Equipment Room prior to waste load out and placement is secure asbestos waste storage bins or equivalent.

C. Glove Bag Technique (ACM pipe & fitting TSI, ACM flange gaskets)
   1. Follow the General and Class I Preparation Steps as indicated above.
   2. Install glovebags in accordance with manufacturer instruction and regulation. Smoke test prior to use.
   3. Wrap any loose and friable ACM adjacent to and at the glove bag installation location with two layers of six mil plastic sheeting.
   4. At least two qualified workers are to perform all Class I glovebag operations.
   5. Thoroughly wet TSI or other ACM with amended water prior to and during removal operation to saturate the ACM. Any insulation to remain shall be cut clean to form a smooth clean edge 6” back from the original end of the insulation. Thoroughly clean the pipe and/or fitting and the inside of the glove bag.
   6. Encapsulate all surfaces inside the glove bag; seal raw ends of insulation to remain with lagging cloth and sealant; evacuate the bag with a HEPA vacuum; tie off the waste bag section; remove all tools from bag; remove the bag from the pipe, folding the side of the bag inward; then twist and tape the open end, the wand opening and the vacuum opening.
   7. Place the removed glove bag in another six mil labeled asbestos waste bag and seal air tight.
   8. Place all asbestos contaminated wastes in a secure waste storage area in a labeled drum or container pending disposal.

3.6 CLASS II ASBESTOS REMOVAL OPERATIONS

A. Prepare Work Area as indicated above for Class II Operations

B. Removal of Gypboard with ACM joint compound and/or ACM texture compounds
   1. Mist the gypsum board, taping compound, and texture compounds continuously with amended water during removal operations;
2. Remove in as intact manageable large sections to extent feasible using utility knives and pry bars and other appropriate tools to removal wallboard system from framing. Use claw hammers as necessary to remove fasteners.

3. Place removed wallboard and associated debris in asbestos labeled waste bags or containers. Wet removed ACM contaminated materials with amended water as it is removed and packaged. Include potentially contaminated wall insulation in the ACM waste bags or containers.

4. Complete removal and clean up by cleaning or removing all nails and fasteners, cleaning all junction boxes, conduit, wire, outlets, plumbing, framing and other surfaces in the work area.

C. Removal of Intact Fire Doors, Sink with ACM Undercoats

1. Disassemble or remove intact without disturbing associated ACM. Class II Work Area Preparation is not required if component can be removed intact.

2. Wrap and seal in plastic sheeting and label for disposal as ACM. Dispose of fire doors as a hazardous ACM waste and undercoated sinks as non-hazardous ACM.

D. Removal on Non-Friable Exterior ACM Caulking, Sealants, Fire Stop, and Window Glazing Compounds

1. Establish a Regulated Area with warning signage and a drop sheet below the removal that extends from the building wall or foundation to at least 5 feet beyond the removal location.

2. Use wet methods and removal the ACM intact as feasible placing removed ACM directly into labeled waste bags or containers.

3. Window putty may be removed with the entire window if the windows are to be demolished. Entire window must be double bagged or wrapped in 6 mil plastic and labeled with asbestos warning labels.

E. Removal of Resilient Flooring Materials and Mastics

1. Remove flooring (sheet & tiles) and any flooring backing intact as is feasible-no sanding or grinding is allowed;

2. Resilient sheet flooring shall be removed by cutting into manageable strips while wetting at cut or snip point and while wetting flooring including any backing during removal;

3. Remove resilient floor tiles intact as feasible using spud bars or other hand tools to separate from floor substrate, wetting throughout process with amended water;

4. Mechanical Removal, if conducted, must be performed in a NPE meeting Class I requirements.

5. All scraping of residual adhesive (mastic) or backing shall be by wet methods. Solvent removal coupled with mechanical removal must be performed in a NPE as above. Solvents use must not result in a solvent based hazardous waste;

6. All removed flooring materials must be bagged or containerized as asbestos waste. Intact non-friable ACM flooring shall be transported and disposed of as a non-hazardous asbestos waste. Friable ACM flooring wastes must be treated as hazardous asbestos wastes.
3.7 FINAL ASBESTOS DECONTAMINATION

A. Previous Work: During completion of the asbestos removal and visible debris clean up work specified, the first cleaning of all exposed equipment and building surfaces must be completed.

B. Clean any remaining materials and debris exposed by the protective barrier removal. All critical isolation barriers, vents, grilles, diffusers, etc., shall remain in place in interior containments and Regulated Areas;

C. Clean all exposed surfaces in the Work Area containment or Regulated Area by wet wiping and HEPA vacuuming.

D. At the completion of this cleaning phase, the Work Area shall be free of all unnecessary equipment/materials and waste containers.

E. The Contractor’s Competent Person/Supervisor shall perform a complete visual inspection of the Work Area under adequate lighting to ensure that the Work Area is free of visible asbestos material, debris, and dust.

F. Notify the Owner’s Observation Service at least 48 hours in advance of the day and time when the Work Area will be ready for Final Inspection and Clearance.

G. The Contractor’s Competent Person/Supervisor shall ensure that additional cleaning is completed if the area is not acceptably clean. The Contractor shall request a final visual inspection by the Observation Service once the Competent Person/Supervisor concludes that the area is acceptable for final visual inspection.

H. After written notification to proceed from the Observation Service, encapsulate all surfaces within the Work Area.

I. After written notification from the Observation Service that the abatement was fully completed and successfully decontaminated based on clearance inspection and testing, the Contractor may proceed with removal of critical barriers and containment materials.

3.8 LEAD-RELATED DEMOLITION

A. General. All painted or coated surfaces at this site are known or presumed to contain lead subject to worker protection and environmental regulations. Refer to the hazard communication included in this section and referenced survey documents for additional information including components with LBP requiring agency notification.

B. Conduct selective demolition work in a manner that does not result in site contamination above background levels. Use wet methods for dust suppression and clean up.

C. Clean up any selective demolition-related lead wastes including any resulting paint chips and debris using wet methods and HEPA vacuuming.

D. The Contractor shall evaluate each demolition debris waste stream and ensure proper disposal of all generated wastes. All waste profiling and testing required by the disposal site is the responsibility of the Contractor.
3.9 LEAD WASTE CLEAN UP AND EVALUATION

A. Clean up paint chips and debris using wet cleaning methods and HEPA vacuuming. All surfaces shall be free of all visible paint chips, dust and debris. Place all paint chips in a labeled waste bag or container.

B. Place all contaminated cleaning materials, disposal personal protective equipment (PPE) and contaminated plastic in separate waste bags. The Contactor shall assume all lead-related waste is RCRA hazardous waste and shall conduct required waste testing as necessary for disposal at a permitted waste disposal site.

C. All waste streams and waste categories listed below shall be considered lead hazardous waste until proven otherwise through testing. All testing of demolition waste wastes is the responsibility of the Contractor. The Contractor shall be responsible for segregating suspect lead hazardous waste based on potential for exhibiting hazardous waste characteristics. Lead-related wastes are to be segregated into the below listed categories at a minimum.

1. Category I: LBP/LCP paint chips, vacuum bags, used cleaning materials. These materials are typically hazardous wastes.

2. Category II: Plastic sheeting and tape, disposable clothing, and equipment. These materials should be non-hazardous if properly cleaned and decontaminated. However, these items are to be considered hazardous subject to testing.

3. Category III: For general selective demolition, the typically debris will typically be non-hazardous if the vast bulk of the waste materials are non-lead containing materials. However, for selective demolition of LBP finishes and high lead content ceramic tile finishes, the waste stream is assumed to be hazardous unless proven otherwise by testing.

D. Based on the testing protocols, any waste greater than or equal to five (5) ppm lead using STLC or any waste greater than or equal to 1000 ppm lead using the TTLC test shall be considered a California hazardous waste. Any waste greater than 5 ppm based on the federal TCLP test is an RCRA hazardous lead waste.

E. When the TTLC test result is less than 50 ppm lead, no further testing is required for that waste category sampled unless the waste stream or waste generating process changes.

3.10 UNIVERSAL WASTES

A. Carefully remove all fluorescent lighting tubes or lamps and high intensity lamps. Package for disposal as a universal waste at a permitted recycling and/or disposal site.

B. Emergency and exit lighting batteries must be removed, packaged and disposed of as a Universal Waste.

C. Mercury-containing thermostats, switches, and gauges scheduled for demolition or replacement, shall be packaged for disposal as a universal waste at a permitted mercury recycling site.
3.11 REMOVAL AND RECYCLING OF OZONE DEPLETING COOLANT GASSES

A. All air conditioning equipment, refrigerators, refrigerated drinking water fountains, and other equipment with coolant gasses shall be assumed to contain regulated chlorofluorocarbon (CFC) and/or HCFC gasses subject to federal and state regulation pertaining to containment and recycling of the gasses. When scheduled for removal, the coolant gasses must first be properly removed.

B. Use only properly EPA certified Refrigerant Reclaimers to remove CFC or HCFC from equipment to be demolished and scrapped.

C. Remove CFC & HCFC gasses using approved equipment and methods which prevent escape to the atmosphere and recycle removed gasses in accordance with applicable federal and state regulation.

D. Removed refrigerant gasses must be recycled or destroyed per regulation.

3.12 IONIZATION TECHNOLOGY SMOKE DETECTORS

A. Assume all smoke detectors are of ionization technology type with radioactive sources (Americium 241) unless visual inspection of each unit indicates otherwise. Ionization technology smoke detectors are typically indicated with an “I” or the word “ionization” on the front or back side of the detector. Photoelectric smoke detectors do not contain radioactive materials and are indicated with a “P” or the word “photoelectric”.

B. Inspect each smoke detector and determine if it is of “ionization” type or “photoelectric” type.

C. Photoelectric Technology Smoke Detectors. Remove the smoke detector batteries and dispose of photoelectric type smoke detectors as construction trash.

D. Ionization Technology Smoke Detectors (with radioactive material sources): Remove the battery and dispose of the ionization type smoke detector in accordance with federal, state and local regulation. Some smoke detector manufacturers will accept spent smoke detectors they manufactured; some hazardous waste collection centers will accept ionization type smoke detectors, and there is one recycling company that accepts spent ionization type detectors (Curie Environmental Services). It is the Contractor’s responsibility to properly identify, remove and dispose of all ionization smoke detectors.

3.13 WASTE PACKAGING & LABELING

A. All asbestos wastes shall be adequately wetted prior to packaging.

B. Place asbestos waste in six (6) mil labeled asbestos waste bags or approved equivalent containers.

C. Goose neck and seal each bag and place in a second clean-labeled bag, drum or impervious container.

D. Decontaminate waste bags and containers prior to removing from regulated or contained area.
E. Label all asbestos waste bags or containers with OSHA warning label and other information as required by regulation.

F. All other hazardous wastes including lead, PCB, and universal wastes shall be properly labeled and containerized in leak tight containers.

3.14 WASTE DISPOSAL

A. Waste Transportation: Submit the method of transport of hazardous asbestos wastes including name, address, EPA ID number, and telephone number of transporter.

B. Waste Disposal Site(s): Submit for approval the name, class, address, EPA ID number, and telephone number of waste disposal site(s) to be utilized.

C. Waste Manifest: Submit for approval at the Pre-construction meeting a filled out Waste Manifest form. For Waste Manifest purposes, the Generator is the facility of the subject work.
   1. Obtain necessary information including generator EPA number for this purpose from the Owner or Owner’s Representative prior to start up of any abatement or demolition.
   2. After removal and packaging waste for shipment, provide a copy of the Waste Manifest to the Observation Service for each required shipment.
   3. Use the Uniform Hazardous Waste Manifest for hazardous wastes including lead and asbestos. Include a properly completed Land Disposal Restriction Notice and Certification form with each manifest submitted for signature by the generator (Owner) where required.
   4. Use a non-hazardous wastes manifest for disposal of non-friable asbestos wastes.

D. Each hazardous waste manifest and each non-hazardous asbestos waste manifest shall be prepared for the Owner or Owner’s Representative’s review and approval prior to shipment.

E. The sealed hazardous waste containers shall be delivered to the Contractor’s pre-designated, approved hazardous waste treatment and waste disposal site for treatment, destruction, and/or burial in accordance with applicable state and federal regulations. Likewise, non-hazardous asbestos waste shall be delivered under manifest to a permitted asbestos waste disposal site.

F. Notify the Owner’s facility representative 48 hours in advance of the time when contaminated materials are to be removed and transported from the site to allow for manifest review and approval.

G. The Contractor shall be responsible for safe handling and transportation of all hazardous waste generated by this Contract to the designated Hazardous Waste Site and shall hold the Owner and the Owner’s agents and consultants harmless for claims, damages, losses, and expenses against the Owner, including attorney’s fees arising out of our resulting from asbestos and hazardous materials spills on the site or en route to the disposal site.
3.15 AIR MONITORING & CLEARANCE TESTING

A. Area Air Monitoring.

1. Throughout the asbestos removal or disturbance process, area air monitoring may be conducted by the Observation Service to ensure work is done in conformance with the fiber concentration limits of these specifications. Likewise, lead removal work areas may be visually inspected and/or air monitored during disturbance activities including removal, treatment or demolition.

2. If results of area asbestos air monitoring outside the Work Area are in excess of 0.01 f/cc for asbestos regulated work areas or in excess of the airborne lead action levels (30 mg/m³ as TWA) at the Work Area perimeter or 0.45 micrograms of airborne lead per cubic meter of air at the project fence line, the Contractor shall make changes in work procedures to assure compliance with minimum standards. No visual emissions outside the Work Area is allowed for hazardous material disturbing activities. At a minimum, the Contractor shall stop all work and implement additional remedial controls and conduct decontamination as necessary in response to exceeding these limits and conditions.

3. Unsatisfactory asbestos results are fiber counts in excess of 0.01 f/cc by PCM Method NIOSH 7400 determined as a TWA outside the Work Area by general air monitoring. All results greater than 0.01 f/cc shall be subject to further laboratory analysis by the TEM method at the Contractor’s sole expense.

B. Clearance Testing

1. Asbestos Removal or Disturbance. When all work including decontamination of a specific asbestos removal work area is complete, the Owner’s Observation Service shall conduct clearance testing prior to containment removal and opening the area to unrestricted access. In order to facilitate clearance inspection and testing, the Contractor is obligated to provide at least 48 hours notice to allow scheduling of the Owner’s Observation Service.

   a. Clearance Testing shall meet AHERA clearance standards for Class I or II removal work and shall include at minimum a set of five PCM samples and results for each sample less than 0.01 fibers per cubic centimeter of air. If TEM samples are requested and paid for by the Contractor, the acceptable clearance results is an average of less than 70 asbestos structures per square millimeter of filter areas. Exceptions: Removal of non-friable ACM intact and intact fire doors with friable ACM may be cleared by visual inspection at the discretion of the Observation Service.

   b. Failed clearance results shall results in the Contractor re-cleaning and encapsulating the Work Area and paying for any additional clearance testing costs including consultant labor and analytical costs.

2. Lead Demolition or significant disturbance (>2 square feet/work area) of lead-based paint (LBP). After all removal/disturbance work is completed and the work area has been decontaminated by wet cleaning and HEPA vacuuming, the Owner’s Observation Service may require or conduct lead wipe testing of surfaces prior to release of the areas for unrestricted use. Lead contamination of floors and other horizontal surfaces shall be less than 40 micrograms of lead per square foot based on lead wipe sampling.
3.16 CLOSE-OUT

A. All submittal and punch list items must be complete and provided to the Observation Service.

END OF SECTION
SECTION 23 08 10 – COMMISSIONING OF HVAC SYSTEM SUPPLEMENT

PART I. GENERAL

1.1 WORK INCLUDED
   A. Systems and equipment testing and start-up.
   B. Validation of proper and thorough installation of Division 15 systems and equipment.
   C. Systems balancing verification.
   D. Prefunctional performance testing of equipment and systems.
   E. Documentation of tests, procedures, and installations.
   F. Coordination of Training Events.
   G. Generic Start-Up Procedures for mechanical systems and equipment.

1.2 GENERAL DESCRIPTION
   A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Owner’s operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
   B. Commissioning Authority (CxA) is retained by the Owner and shall work with the Contractor and the Design Engineer to direct and oversee the Cx process and perform functional performance testing.
   C. This Section outlines the Cx procedures specific to the Division 23 Contractors. Requirements common to all Sections are specified in Section 019113 and the Commissioning Plan.

1.3 SCOPE
   A. The following are included in the Scope of Commissioning on this project:
   B. Mechanical/HVAC Systems
      1. Chillers (CHs)
      2. Pumps (Ps)
      3. Air Handling Units (AHUs)
      4. Air Flow Measuring Stations (AFSs)
      5. Boilers (Bs)
      6. Fan Coil Units (FCUs)
      7. Heat Pumps (HPs)
      8. Supply Fans (SFs)
      9. Exhaust fans (EFs)
     10. Variable Frequency Drives (VFDs)
     11. Variable Air Volume Boxes (VAVs)
     12. 
   C. Building Automation Systems
      1. DDC control system
1.4 RELATED WORK AND DOCUMENTS

A. Commissioning Plan: The Commissioning Plan (Cx Plan) outlines the commissioning process beyond the construction specification. All Contractor responsibilities are outlined in Specifications. Cx Plan is available to the Contractor to understand the context of their responsibilities but does not define any additional responsibilities of the Contractor.

B. Section 019113 – General Cx Requirements: Details the common Cx requirements common across all Divisions beginning with the Construction Phase. Focus is on Contractors responsibilities for the Cx process.

C. Where conflicts occur between this specification section and section 23 08 00 Commissioning of HVAC Systems, this section shall take precedence.

1.5 DEFINITIONS AND ABBREVIATIONS

A. Refer to Section 019113 and the Cx Plan.

1.6 REFERENCE STANDARDS


B. ASHRAE Guideline 4-1993, “Preparation of operating and Maintenance Documentation for Building Systems”

C. NEBB - Procedural Standards for Building Systems Commissioning

1.7 DOCUMENTATION

A. In addition to the documentation required in Section 01800, Contractor shall provide to the CxA the following per the procedures specified herein, in the Cx Plan, and in other Sections of the specification:

1. Balancing Plan: The plan shall include the following:
   a) Certifications on all instrumentation to be used throughout the testing. This must document certification within the last 6 months.
   b) Résumés and Certification of individuals who will be balancing systems
   c) Detailed step by step plans for each procedure to be performed.
   d) Sample forms to be used for each measurement
   e) Sample balancing report
   f) All referenced charts such as applicable manufacturer’s balance valves, vibration severity chart and room noise criteria (NC) curves.
   g) Vibration Severity Charts

2. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase. Factory Test Reports should be provided in PDF electronic format. These may include, but are not limited to:
   a) Air Handling Units
   b) VRF Fan Coil Units
   c) VRF air-cooled Condensing Units

3. Field Testing Agency Reports (other than TAB): Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in PDF electronic format. These may include but are not limited to:
1.8 SEQUENCING AND SCHEDULING
   A. Refer Section 019113 and the Cx Plan.

1.9 COORDINATION MANAGEMENT PROTOCOLS
   A. Coordination responsibilities and management protocols relative to Cx are initially defined in Section 019113 and the Commissioning Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off meeting. Contractor shall have input in the protocols and all Parties will commit to scheduling obligations. The CxA will record and distribute.

1.10 CONTRACTOR RESPONSIBILITIES
   A. Refer to Section 019113: Detailed Contractor responsibilities common to all Divisions are specified in Section 019113. The following are additional responsibilities or notable responsibilities specific to Division 23.
   
   B. Construction Phase
   1. Provide skilled technicians qualified to perform the work required.
   2. Provide factory-trained and authorized technicians where required by the Contract Documents.
   3. Prepare and submit required draft Start-Up Procedures and submit along with the manufacturer’s application, installation and start-up information.
   4. The following should be merged into the TAB Section. If you have the opportunity to do that, simply reference the section here. Where not include it all here.
   5. TAB: Specifically as it relates to Cx:
      a) Attend Cx kick-off meeting and Cx progress meetings during Acceptance Phase.
      b) Submit Balancing Plan as indicated above
      c) Meet with Cx Team to review TAB procedures and documentation required.
      d) As called by CxA, participate in CxT demonstrations of balancing procedures for repetitive procedures such as zones.
      e) Participate in applicable Action Item resolution
      f) Provide all documentation electronically.
   6. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this Section.
   7. Start-up, and test/adjust/balance systems and equipment prior to functional performance testing by the CxA. Start-Up Procedures shall be in accordance with Contract Documents, reference or industry standards, and specifically elsewhere in Part I of this Section.
   8. Record Start-up Procedures on start-up procedure forms and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the Party actually performing the task or procedure.

   C. Acceptance Phase
1. Assist CxA in Functional Performance Testing if requested. Assistance may generally include the following:
   a) Manipulation of systems and equipment to facilitate testing (as dictated in Section 019113 and the Cx Plan);
   b) Provide any specialized instrumentation necessary for functional performance testing;
   c) Manipulation of BAS and other control systems to facilitate functional performance testing (as dictated Section 019113 and the Cx Plan).
   d) Attendance of Cx meetings as required to resolve issues and answer questions.

D. Warranty Phase
1. Maintain record documentation of any configurations, set ups, parameters etc, that change throughout the period.
2. Provide representative for off-season testing if necessary.
3. Respond to Warranty issues as required by Division 1 and the General Conditions.

1.11 EQUIPMENT SUPPLIER RESPONSIBILITIES
A. Refer to Section 019113.

1.12 CONTRACTOR NOTIFICATION AND SCHEDULING
A. Refer to Section 019113.

1.13 START-UP PROCEDURES AND DOCUMENTATION
A. Refer to Section 019113.

1.14 EQUIPMENT NAMEPLATE DATA
A. Refer to Section 019113.

1.15 BAS TRENDING REQUIREMENTS
A. Trends are historical archives on computer disks that document the operation of the systems and equipment. Trends can be interval recordings of system I/O parameters or Change-of-Value-based trends that record when a system value changes by more than a specified threshold.
B. CxA will analyze trend logs of the system operating parameters to evaluate normal system functionality. The specific requirements of the trending are specified with the ‘generic’ FPT procedures in the specifications. Contractor shall establish these trends, ensure they are being stored properly, and forward the data in electronic format to the CxA.
C. Trend 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 15 minute 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.
   1. Microsoft Excel Spreadsheet (.xls)
   2. Comma Separated Value (.csv or .txt) preferably with quotes delimiting text fields and # delimiting date/time fields
D. Sample times indicated as COV (±) or change of value mean that the changed parameter only needs to be recorded after the value changes by the amount listed. When output to the trending file, the latest recorded value shall be listed with any given time increment record. If the BAS does not have
the capability to record based on COV, the parameter shall be recorded based on the interval common to the unit.

E. Contractor shall provide the CxA with required passwords, phone numbers, and any other information needed to allow the CxA access to the trend log data and allow downloading to a remote location, if applicable. Contractor shall also provide step-by-step written instructions for accessing the data.

1.16 FUNCTIONAL PERFORMANCE TESTING

A. Contractor shall participate in the initial samples of Functional Performance Testing as stipulated in Section 019113 and the Cx Plan.

1.17 FPT ACCEPTANCE CRITERIA

A. Acceptance criteria for tests are indicated in Section 019113, the specification Sections applicable to the systems being tested, and/or the Cx Plan. Generally, unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device.

1.18 TRAINING

A. Contractors, Subcontractor, Vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of the individual Specifications sections.

PART II. PRODUCTS

2.1 INSTRUMENTATION

A. **General**: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of ± or - 0.1°F.

2. Pressure sensors shall have an accuracy of ± or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

3. All equipment shall be calibrated according to the manufacturer’s recommended intervals. Calibration tags shall be affixed or certificates readily available.

B. **Standard Testing Instrumentation**: Standard instrumentation used for testing air and water flows, temperatures, humidity, noise levels, amperage, voltage, and pressure differential in air and water systems shall be provided by the contractor or the CxA, at the discretion of the CxA.

C. **Special Tools**: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

PART III. EXECUTION

3.1 START-UP PROCEDURES - GENERAL

A. Part III of this Section outlines ‘generic’ or minimally acceptable Start-Up Procedures (delineated as Start-Up Checks and Start-Up Tests) and individual systems Training requirements for systems and equipment. These procedures are the direct responsibility of the Contractor as a basic element
of validating that the installation is correct per normal quality control practices. These items shall provide a minimum or guideline for required Contractor development of Start-Up Procedures. Contractor shall synthesize these minimum requirements along with their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to develop specific and itemized Start-Up Procedures specific to the equipment and systems installed on this project.

3.2 PROCEDURES COMMON TO ALL SYSTEMS

A. The following start up verifications/procedures are common to all systems
B. Checkout shall proceed from devices to the components to the systems.
C. Verify labeling is affixed per spec and visible
D. Verify prerequisite procedures are done.
E. Inspect for damage and ensure none is present.
F. Verify system is applied per the manufacturer’s recommendations
G. Verify system has been start up per the manufacturer’s recommendations
H. Verify that access is provided for inspection, operation and repair
I. Verify that access is provided for replacement of the equipment
J. Verify the record drawings, submittal data and O&M documentation accurately reflect the installed systems
K. Verify all gages and test ports are provided as required by contract documents and manufacturer’s recommendations
L. Verify all recorded nameplate data is accurate
M. Installation is done to ensure safe operation and maintenance.
N. Verify specified replacement material/attic stock has been provided as required by the Construction Documents
O. Verify all rotating parts are properly lubricated
P. Verify all monitoring and ensure all alarms are active and set per Owner’s requirements
Q. Complete all nameplate data and confirm ratings conform with the design documents

3.3 VALVES

A. Start-Up Checks: Perform the following checks during start-up and as specified in manufacturer's instructions:
   1. Operate all valves, manual and automatic, through their full stroke. Ensure smooth operation through full stroke and appropriate sealing or shutoff.
   2. Verify actuators are properly installed with adequate clearance.
   3. Verify all valves are labeled per the construction documents. Confirm that concealed valves are indicated on the finished building surface.
   4. For automatic pneumatically-operated valves, verify spring range and adjust pilot positioners where applicable. For electronically operated valves, check the stroke and range. For all automated valves controlled by a program, ensure that the minimum and maximum stroke and ranges on the valves are coordinated with the limits entered in the program.
3.4 METERS AND GAGES

A. **Start-Up Checks:** Perform the following checks during start-up and as specified in manufacturer's instructions:

1. Adjust faces of meters and gages to proper angle for best visibility.
2. Clean windows of meters and gages and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint. For meters and gages requiring temporary manual connection of read-out device such as pressure taps on a flow measuring device, ensure threads are clean and that connection can be made easily.
3. Meters and gages requiring manual connection of readout device shall be installed with adequate access to allow connection of device with normal tools.
4. Confirm the dial face range of all gages encompasses the expected system range of operation or state any concerns about the range not being correct.

3.5 MECHANICAL IDENTIFICATION

A. **Start-Up Checks:** Perform the following checks:

1. Verify all valve tags, piping, duct, and equipment labeling corresponds with drawings and indexes and meets requirements specified. Correct any deficiencies for all piping and duct systems.
2. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
3. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.6 MECHANICAL INSULATION

A. **Start-Up Checks:** Examine all piping, systems and equipment specified to be insulated.

1. Ensure quality of insulation. Patch and repair all insulation damaged after installation.
2. Ensure the integrity of vapor barrier around all cold surfaces.

3.7 REFRIGERANT PIPING - GENERAL

A. **Start-Up Checks:** These Procedures apply to refrigerant piping systems:

1. Inspect all piping for proper installation, adequate support (with appropriate vibration isolation where applicable), and insulation as required.
2. Provide notification of pressure testing
3. Pressure and/or leak test all applicable systems in accordance with the manufacturer’s requirements as applicable.
4. Submit documentation that the pressure testing complies with manufacturer’s requirements
5. Provide notification of evacuation procedures
6. Evacuate all applicable systems in accordance with the manufacturer’s requirements as applicable.
7. Submit documentation that the evacuation procedures complies with manufacturer’s requirements
8. Verify the operation of applicable safety relief valves, operating controls, safety controls, etc. to ensure a safe installation.
3.8 AC MOTORS
A. **Start-Up Checks**: Perform the following checks during start-up and as specified in manufacturer's instructions:
   1. Verify proper alignment, installation, and rotation.
   2. Verify properly sized overloads are in place
B. **Start-Up Tests**: Perform the following tests, measurements, or procedures during start-up and as specified in manufacturer's instructions:
   1. Measure insulation resistance, phase balance, and resistance to ground.
   2. Measure voltage available to all phases. Measure amps and RPM after motor has been placed in operation and is under load.
   3. Record all motor nameplate data.

3.9 HEAT PUMPS AND AIR-COOLED CONDENSING UNITS
A. **General**: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.
B. **Start-Up Checks**: Perform the following inspections/checks before start-up:
   1. Ensure unit is level
   2. Coils are undamaged and fins are combed
   3. Condenser fan rotates freely and check rotation direction
   4. Ensure vibration isolation integrity is maintained with the fan and compressor installation and the connections to it
   5. Confirm condensing unit model number matches approved submittal.
   6. Record all nameplate data
C. **Start-Up Tests**: Perform the following before or during start-up:
   1. Start-up condensing units, in accordance with manufacturer's start-up instructions.
   2. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
   3. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.
D. **Functional Performance Tests**: This generally refers to a systematic testing of system operation from component-level, to system-level, to integrated systems-level testing to demonstrate compliance with Contract Documents. This will include verification of sequences, normal and emergency operations, calibration, interfaces, and interlocks, etc.
E. **Training**: Factory-authorized representative shall train Owner's maintenance personnel including:
   1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
   2. Familiarization with contents of Operating and Maintenance Manuals.

3.10 PUMPS
A. **Start-Up Checks**: Perform the following before or during start-up:
   1. Start-up pump in accordance with manufacturer’s start-up instructions.
   2. Inspect and confirm suction and discharge piping components meet design requirements.
   3. Confirm pump model number matches approved submittal. Record all nameplate data.
4. Confirm pump installation and mounting meets project and manufacturer requirements. Pad provided (if applicable), vibration isolation in place, frame secured to pad, frame grouted as necessary, piping and piping components are properly supported including suction diffusers and nameplate location will be visible after insulation or nameplate information is copied and displayed elsewhere on pump.

5. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

6. Prime pump bleeding air from pump following manufacturer’s instructions.

**B. Functional Performance Tests:** This generally refers to a systematic testing of system operation from component-level, to system-level, to integrated systems-level testing to demonstrate compliance with Contract Documents. This will include verification of sequences, normal and emergency operations, calibration, interfaces, and interlocks, etc.

**C. Training:** Contractor shall train Owner's maintenance personnel including:

1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.

2. Familiarization with contents of Operating and Maintenance Manuals.

### 3.11 CHILLERS

**A. General:** Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.

**B. Start-Up Checks:** Perform the following inspections/checks before or during start-up:

1. Ensure unit is level

2. Coils are undamaged and fins are combed

3. Condenser fan rotates freely and check rotation direction

4. Installation of chiller and piping accessories at chiller are in conformance with design and manufacturer’s requirements. Pad provided, correct spring isolation installed, unit secured to pad, all manufacture’s service and maintenance clearances are adhered to.

5. Confirm chiller model number matches approved submittal and was provided with all required accessories. Record all nameplate data.

6. Confirm controls shipped loose are installed including flow switches, water temp sensors, etc. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

7. Confirm building automation system control wiring interface is complete including hard-wired control and network interfaces.

8. Confirm hydronic system has been balanced with evaporator and condenser sections receiving water flow rate associated with design flow requirements.

9. Confirm chilled water and condenser water is filtered and treated with chemical report indicating water is in compliance with design requirements.

**C. Functional Performance Tests:** This generally refers to a systematic testing of system operation from component-level, to system-level, to integrated systems-level testing to demonstrate compliance with Contract Documents. This will include verification of sequences, normal and emergency operations, calibration, interfaces, and interlocks, etc.

**D. Training:** Contractor shall train Owner's maintenance personnel including:

1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.

2. Familiarization with contents of Operating and Maintenance Manuals.
3.12 BOILERS

A. **General:** Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.

B. **Start-Up Checks:** Perform the following inspections/checks before or during start-up:
   1. Confirm boiler has been installed per manufacturer and design requirements.
   2. Confirm boiler model number matches approved submittal and was provided with all accessories. Record all nameplate data.
   3. Installation heating water piping accessories at boiler are in conformance with design and manufacturer's requirements.
   4. Confirm boiler pad is provided, boiler secured to pad, all manufacture’s service and maintenance clearances are adhered to.
   5. Confirm components and controls shipped loose are installed including low water cutout, condensate neutralization, water temp sensors, etc. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
   6. Confirm building automation system control wiring interface is complete including hard-wired control and network interfaces.
   7. Confirm hydronic system has been balanced with boiler receiving water flow rate associated with design flow requirements.
   8. Confirm heating water is filtered and treated with chemical report indicating water is in compliance with design requirements.

C. **Functional Performance Tests:** This generally refers to a systematic testing of system operation from component-level, to system-level, to integrated systems-level testing to demonstrate compliance with Contract Documents. This will include verification of sequences, normal and emergency operations, calibration, interfaces, and interlocks, etc.

D. **Training:** Contractor shall train Owner's maintenance personnel including:
   1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
   2. Familiarization with contents of Operating and Maintenance Manuals.

3.13 VARIABLE SPEED DRIVES

A. **General:** Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.

B. **Start-Up Checks:** Perform the following inspections/checks before or during start-up:
   1. Confirm drive has been installed per manufacturer and design requirements.
   2. Confirm NEMA rating of drive housing is in compliance with the environment.
   3. Confirm drive is installed in compliance with NEC codes including service and access clearances.
   4. Confirm drive model number matches approved submittal.
   5. Confirm boiler pad is provided, boiler secured to pad, all manufacture’s service and maintenance clearances are adhered to.
   6. Confirm components and controls shipped loose are installed including low water cutout, condensate neutralization, water temp sensors, etc. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
7. Confirm building automation system control wiring interface is complete including hard-wired control and network interfaces.

3.14 AIR HANDLERS

A. General: Contractor to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.

B. Start-Up Checks: Perform the following inspections/checks before start-up:

1. Inspect the field assembly of components and installation of fan system including ductwork, and electrical connections. Installation to meet design pressure classification.
2. Confirm fan model number and nameplate data matches approved submittal. Record all nameplate data.
3. Confirm field hydronic piping connections and electrical conduit do not conflict with fully opening any doors, use of motor hoist rails or hinder any other service or maintenance access.
4. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils entering air face. Ensure volatile irritants are contained and kept out of occupied spaces.
5. Adjust and lubricate dampers and linkages for proper damper operation.
6. Verify unit is secure on mountings and supporting devices and that connections for ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
7. Ensure vibration isolation integrity is maintained with the fan installation and the connections to it.
8. Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
9. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
10. Stroke all dampers to ensure free and full travel

C. Functional Performance Tests: This generally refers to a systematic testing of system operation from component-level, to system-level, to integrated systems-level testing to demonstrate compliance with Contract Documents. This will include verification of sequences, normal and emergency operations, calibration, interfaces, and interlocks, etc.

D. Training: Contractor shall train Owner's maintenance personnel including:

1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of Operating and Maintenance Manuals.

3.15 SUPPLY AND EXHAUST FANS

A. General: Contractor to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.

B. Start-Up Checks: Perform the following inspections/checks before start-up:

1. Inspect the field assembly of components and installation of fan system including ductwork, and electrical connections.
2. Confirm fan model number and nameplate data matches approved submittal.
3. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils entering air face. Ensure volatile irritants are contained and kept out of occupied spaces.

4. Adjust and lubricate dampers and linkages for proper damper operation.

5. Verify unit is secure on mountings and supporting devices and that connections for ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.

6. Ensure vibration isolation integrity is maintained with the fan installation and the connections to it.

7. Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.

8. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

9. Stroke all dampers to ensure free and full travel.

C. **Functional Performance Tests**: This generally refers to a systematic testing of system operation from component-level, to system-level, to integrated systems-level testing to demonstrate compliance with Contract Documents. This will include verification of sequences, normal and emergency operations, calibration, interfaces, and interlocks, etc.

D. **Training**: Contractor shall train Owner's maintenance personnel including:
   1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
   2. Familiarization with contents of Operating and Maintenance Manuals.

3.16 **BUILDING AUTOMATION AND CONTROL SYSTEMS**

A. **Start-Up Checks**: Perform the following checks before start-up and as specified. Packaged control systems embedded in furnished equipment such as variable refrigerant flow systems is included in this requirement:
   1. Repair and/or replace any damaged equipment or sensors
   2. Point-to-point checkout

B. **Start-Up Tests**: This generally requires manufacturers authorized representative to start-up, test, adjust, and calibrate direct digital and other microprocessor-based control systems and demonstrate compliance with requirements. This will include verification of sequences, normal and emergency operations, calibration, interfaces, and interlocks, etc.

C. **Functional Performance Tests**: This generally refers to a systematic testing of system operation from component-level, to system-level, to integrated systems-level testing to demonstrate compliance with Contract Documents. This will include verification of sequences, normal and emergency operations, calibration, interfaces, and interlocks, etc.

3.17 **TESTING, ADJUSTING, AND BALANCING**

A. **Reference**: Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the respective section and the referenced standards.

B. **Start-Up Checks**: In addition to specifications, perform the following as a minimum:
   1. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
   2. Patch insulation, ductwork, and housings, using materials identical to those removed.
3. Seal ducts and piping, and test for and repair leaks.
4. Seal insulation to re-establish integrity of the vapor barrier.
5. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
6. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.
7. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

C. Training:
   1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures.
   2. Review for the Owner’s personnel the locations of TAB reports and data.

3.18 SEQUENCING ILLUSTRATION
   A. Reference Section 019113.

END OF SECTION 23 08 10
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. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, and bollard foundations.

7. 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.

8. 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).

9. 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.

10. Miscellaneous Lumber and Framing Work: Include wood grounds, nailers, blocking, fasteners, and anchorage for support of security materials and equipment.

11. 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.

12. Locking Hardware: Include interface to electronic hardware and door controllers on security related doors.

13. Access Panels and Doors: Required in walls, ceilings, and floors to provide access to security devices and equipment.

14. 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.

15. 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:

1. Underwriter’s Laboratories (UL): Applicable listing and ratings.
   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 28xxx 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 District.
2. Security at the new facility will consist of access control and alarm monitoring.
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.

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”

4. Content:
   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 confirm 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 not 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 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
   2. Water Blocked Cable
      a. #18/2 AWG unshielded with Aquaseal tape: West Penn #AQC224, door contact cable
      b. #18/4 AWG unshielded with Aquaseal tape: West Penn #AQC244, REX and alarm device cable
      c. #18/6 AWG shielded (overall) with Aquaseal tape: West Penn #AQC3186, card reader cable
      d. #16/2 AWG unshielded with Aquaseal tape: West Penn #AQC225, lock power cable
      e. #14/2 AWG unshielded with Aquaseal tape: West Penn #AQC226, lock power cable from local power booster to exit device

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
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
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 client workstations
2. ACAMS control panels, input/output modules, and card readers
3. ACAMS power supplies
4. Alarm initiating devices, including: magnetic switch contacts, and request-
to-exit sensors.
5. Interface to electric door hardware and ADA door operators
6. Interface to elevator controls
7. Interface to fire/life-safety system
8. 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 and 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
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
      3. Wireless Card Reader interface modules
         a. Alarm contacts and request-to-exit sensors
         b. Local audible alarms
         c. Interface to electrified door hardware
         d. Interface to ADA auto operators and actuators
         e. Interface to fire/life-safety system
         f. Interface to elevator controller
         g. Hardwired interfaces to IDS
         h. Cable conductors (identify conductors on the point-to-point diagrams with the
            same tag as the installed conductor)
      4. Schedules: Provide schedules for ACAMS control panels that show each point
         ID with a description of the connected devices.
      5. Block Diagram/Riser Diagram: Show the ACAMS components, conduit, wire
         types, and sizes between them, including cabling interties between termination
         hardware.
      6. 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
   b. Dell # USB Multimedia Pro keyboard
   c. Dell # USB optical mouse
   d. 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

C. Overhead Roll-Up Doors
   1. General
a. Mounting: Surface  
b. Contacts: Single Pole, Single Throw  
c. Gap Distance: 3.0” maximum  
d. Wiring: Armor Cable, 12” minimum

2. Manufacturer  
a. GE Security # 2205 floor mounted contact switch with 3’ armored cable lead  
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/duress 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 conduit 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 database 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.
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:
   1. Excavating and filling for rough grading the Site.
   2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
   3. Excavating and backfilling for buildings and structures.
   4. Drainage course (capillary break material) for slabs-on-grade for buildings.
   5. Excavating and backfilling for buried mechanical and electrical utilities and pits for buried utility structures.

1.3 REFERENCES

A. ASTM International:
   1. ASTM D 448: Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
   2. ASTM D 1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   5. ASTM D 2167: Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   8. ASTM D 6938: Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. California Code of Regulations:
   1. Title 8 – Industrial Relations (Cal/OSHA Standards).
1.4 DEFINITIONS

A. Backfill: Soil material or controlled-low-strength material used to fill an excavation.

B. Base Course: Aggregate layer placed between the subgrade and surface pavement in a paving system.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Course of washed granular material supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner’s geotechnical testing agency. Unauthorized excavation, as well as remedial work directed by geotechnical testing agency, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that 3/4 cubic yard or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subgrade: Uppermost surface of an excavation, or top surface of a fill or backfill immediately below base course, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct preexcavation conference at Project site:
   1. Review methods and procedures related to earth-moving, including, but not limited to, the following:
      a. Personnel and equipment needed to make progress and avoid delays.
      b. Coordination of Work with utility locator service.
      c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
      d. Extent of trenching by hand or with air spade.
      e. Field quality control.
1.6 ACTION SUBMITTALS

A. Soil Samples: As required by Owner’s geotechnical testing agency for sampling and testing of proposed offsite borrow soil material.
   1. Deliver a representative sample of each type of imported borrow material to Owner’s geotechnical testing agency’s laboratory at least 7 working days prior to delivery to site, for evaluation and testing.

1.7 INFORMATIONAL SUBMITTALS

A. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth-moving begins.

1.8 QUALITY ASSURANCE

A. Geotechnical Testing and Inspection: Owner will employ and pay for a qualified independent geotechnical testing and inspection agency to perform soils testing and inspection services during earthwork operations. All imported borrow materials must be approved by Owner’s geotechnical testing agency.

1.9 FIELD CONDITIONS

A. Project Soils Information: Data in subsurface investigation report referenced below was used for basis of design, and is available to Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. Opinions expressed in subsurface investigation report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer.
   1. “Geotechnical Engineering Investigation Report Contra Costa College District Headquarters, 500 Court Street, Martinez, California dated October 18, 2017 by Kleinfelder, Inc.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
   1. Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation, if required. Repair damaged utilities to satisfaction of utility owner.
   2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect, and then only after acceptable temporary utility services have been provided.
      a. Provide minimum 5 working days notice to Architect, and receive written notice to proceed before interrupting any utility.
   3. Demolish and completely remove from site existing underground utilities identified for removal. Coordinate with utility companies for shutoff of services if lines are active.
C. Use of explosives is not permitted.

D. Protection of Persons and Property:
   1. Barricade open excavations and post with warning lights as per requirements of authorities having jurisdiction.
      a. Conform with all applicable occupational safety regulations.
   2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
   3. Excavation within dripline of trees to remain to be performed by hand. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

E. Dust Control: Conduct earthwork operations so as to prevent windblown dust and dirt from interfering with Owner’s and adjacent property owners’ normal operations.

F. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

G. Do not commence earth-moving operations until temporary erosion- and sedimentation-control measures, specified in Division 1, are in place.

H. Tree- and Plant Protection Zones:
   1. The following practices are prohibited within tree- and plant-protection zones:
      a. Storage of construction materials, debris, or excavated material.
      b. Parking vehicles or equipment.
      c. Foot traffic.
      d. Erection of sheds or structures.
      e. Impoundment of water.
      f. Excavation or other digging unless otherwise indicated.
      g. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
   2. Do not direct vehicle or equipment exhaust towards tree- and plant-protection zones.
   3. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: [ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock and gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter].

1. Onsite native soils below the stripped layer having an organic content of less than [3] percent by weight are suitable for use as fill and backfill at the site, subject to specified requirements for engineered fill and non-expansive fill.

C. Engineered Fill: [Satisfactory soils with an organic content of less than 3 percent by weight, free of hazardous or deleterious materials; containing not more than 15 percent of material larger than 1-1/2 inches, and containing at least 20 percent passing the No. 200 sieve].

D. Non-Expansive Fill: Meeting the same criteria as engineered fill, and the following:

1. [Plasticity Index of 12 or less, or Expansion Index of less than 20].

E. Drainage Course (Capillary Break): Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.2 MISCELLANEOUS MATERIALS

A. Controlled-Low-Strength Material: Refer to Section 31 23 26 “Controlled-Low-Strength Material.”

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage caused by rain or water.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary ditches.

3.3 EXCAVATION, GENERAL

A. Do not use explosives.

B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and subsurface conditions encountered.
   1. If excavated materials intended for fill or backfill include unsatisfactory soil materials and rock, replace with satisfactory material approved by Owner’s geotechnical testing agency.
   2. Refer to Section 31 10 00 "Site Clearing" for removal of surface pavements and below-grade improvements.

[or]

C. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Owner’s geotechnical testing agency. The Contract Sum will be adjusted for rock excavation according to unit prices included in Division 1. Changes in the Contract Time may be authorized for rock excavation, if justified by construction schedule.
   1. Refer to Section 31 10 00 "Site Clearing" for removal of surface pavements and below-grade improvements.
   2. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.
      a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
   3. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 24 inches outside of concrete forms other than at footings.
      b. 12 inches outside of concrete forms at footings.
      c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

e. 6 inches beneath bottom of concrete slabs-on-grade.

f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

D. Stability of Excavations:

1. Comply with all applicable codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations. Maintaining stability of excavations is sole responsibility of Contractor.

   a. Support all trench and other excavations in accordance with California Code of Regulations, Title 8 – Industrial Relations (Cal/OSHA Standards), Chapter 4 – Division of Industrial Safety, Subchapter 4 – Construction Safety Orders.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to requirements in Division 1 Section for tree protection.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
3.6 EXCAVATIONS FOR UTILITY TRENCHES  
A. Refer to Section 31 23 33 “Utility Trenching and Backfill” for excavation requirements for utility trenches.

3.7 SUBGRADE INSPECTION  
A. Notify Architect and Owner’s geotechnical testing agency when excavations have reached required subgrade.  
B. If Owner’s geotechnical testing agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed by geotechnical testing agency.  
C. At areas to receive fill and/or concrete slabs on grade, scarify and recompact upper portion of exposed subgrade soil as specified in “Placement and Compaction” Article.  
D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.  
E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner’s geotechnical testing agency, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION  
A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Owner’s geotechnical engineer.  
1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner’s geotechnical testing agency.

3.9 STORAGE OF SOIL MATERIALS  
A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust and saturation from rain.  
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.  
2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill. Comply with all applicable state and local requirements for offsite disposal of soil and other waste materials.

3.10 BACKFILL  
A. Place and compact backfill in excavations promptly, and as specified in “Placement and Compaction” Article, but not before completing the following:  
1. Construction below finished grade, including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
3. Removal of trash and debris from excavations.
4. Removal of temporary shoring and bracing, and sheeting.
5. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Use satisfactory soil material for backfill, except where occurring under structures or exterior concrete paving, use engineered fill material and/or non-expansive fill material as specified in “Fill” Article.

1. Where project conditions prevent the use of properly compacted soil material as backfill, obtain approval of Project Inspector and Owner’s geotechnical testing agency to use controlled-low-strength material in lieu of soil.

C. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 FILL

A. Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fill materials.

B. Scarify upper 12 inches of exposed soil at subgrade areas to receive fill. Recompact scarified soil as specified in “Placement and Compaction” Article.

1. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical in 4 horizontal as directed by Owner’s geotechnical testing agency, so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as specified in “Placement and Compaction” Article. Fill material to be as follows:

1. Under footings and foundations, building slabs-on-grade, and adjacent exterior slabs, use non-expansive fill within the top 12-inch zone below bottom of slab. Capillary break material occurring in upper portion of this zone is considered non-expansive fill.
   a. Place non-expansive fill to extend 5 feet beyond perimeter edges of building slabs, or adjacent exterior slabs, where occur.
   b. Where project conditions prevent the use of compacted soil material as backfill, obtain approval of Project Inspector and Architect to use controlled-low-strength material in lieu of soil.

2. Under exterior concrete paving not occurring adjacent to structures, and exterior concrete steps and ramps, use non-expansive fill within the top 9-inch zone below bottom of slab. Base course material occurring in upper portion of this zone is considered non-expansive fill.
   a. Place non-expansive fill to extend 2 feet beyond perimeter edges of exterior slabs.
   b. Below 9-inch non-expansive fill layer, use engineered fill.
c. Where project conditions prevent the use of compacted soil material as backfill, obtain approval of Project Inspector and Architect to use controlled-low-strength material in lieu of soil.

3. Under asphalt paved areas, use satisfactory soil material.
4. Under grass and planted areas, use satisfactory soil material.

D. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 PLACEMENT AND COMPACTION

A. Place backfill and fill soil materials in layers not more than the following thicknesses in loose depth:
   1. Below Structures and Pavements: Not more than 8 inches for material compacted by heavy compaction equipment, and not more than 4 inches for material compacted by hand-operated tampers.
   2. Below Turf and Planted Areas and Other Unpaved Areas: Not more than 8 inches.

B. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
   1. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

D. Soil Moisture Control: Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to levels indicated.
   1. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds moisture content levels specified.

E. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
   1. Scarify and recompact upper portion of subgrades to receive fill material as follows:
      a. Under Structures: Recompress top 12 inches to a minimum of 95 percent relative compaction, at a moisture content of between 3 and 5 percent above laboratory optimum value.
      b. Under Exterior Paved Areas: Recompress top 6 inches to a minimum of 90 percent relative compaction, at a moisture content of between 3 and 5 percent above laboratory optimum value.
   2. Under structures, compact each layer of fill as follows:
      a. Non-Expansive Fill: Compact each layer to a minimum of 95 percent relative compaction at a moisture content of 1 to 3 percent above laboratory optimum value.
b. Engineered Fill: Compact each layer to a minimum of 95 percent relative compaction at a moisture content of 3 to 5 percent above laboratory optimum value.

3. Under exterior concrete paving, ramps, and steps, and asphalt paving, compact each layer of fill as follows:
   a. Non-Expansive Fill: Compact each layer to a minimum of 90 percent relative compaction at a moisture content of 1 to 3 percent above laboratory optimum value, except, compact upper 12 inches at 95 percent relative compaction at a moisture content of 1 to 3 percent above laboratory optimum value.

4. Under turf and planted areas, compact each layer of fill to a minimum of 90 percent relative compaction at a moisture content of 3 to 5 percent above laboratory optimum value, except, compact upper 18 inches at 85 percent relative compaction at a moisture content of 3 to 5 percent above laboratory optimum value.

F. Correct improperly compacted areas or lifts as directed by Architect and Owner’s geotechnical testing agency if soil density tests indicate inadequate compaction.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

D. Adjustment of Existing In-Ground Utility Boxes: Where existing in-ground utility boxes occur in areas in which finish grade is being adjusted, reset top of utility box to conform with new finish grade.

3.14 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Install subdrainage pipe and drainage course backfill material as specified in Section 33 46 13 “Subdrainage.”
3.15 PAVEMENT BASE COURSES

A. Place base courses under paved areas on prepared subgrade, in indicated thicknesses, and as specified in Section 32 12 16 “Asphalt Paving” and Section 32 13 13 “Site Concrete.”

3.16 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade in indicated thickness as follows:
   1. Place drainage course 6 inches or less in compacted thickness in a single layer.
   2. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent relative compaction according to ASTM D 1557.

C. Refer to Section 03 30 05 “Underslab Vapor Barrier” for placement of sheet membrane vapor barrier over drainage course.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing and observation.
   1. Notify Owner’s testing agency at least 2 working days prior to date when observation and testing services are needed.

B. Allow geotechnical testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by geotechnical testing agency.

D. Geotechnical testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq ft or less of paved area or building slab, but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, at a frequency of no less than 18 inches vertically, but no fewer than two tests.

E. When geotechnical testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil material to depth required; recompact and retest until specified compaction is obtained.
   1. Additional testing and inspection required by failure to meet specified requirements will be at Contractor’s expense.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Owner’s geotechnical testing agency; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of off Owner’s property.

END OF SECTION 31 20 00
REMOVE PORTION OF CURB AS REQUIRED FOR CURB CUT RAMP

REMOVE AC PAVING AS REQUIRED FOR LAYOUT OF CURB RAMP

PAINT OVER EXISTING STRIPING, TYP AND STALL NUMBERS

13 EQ. STALLS AT 8'-6" O.C.

5'-0"

8 EQ. SPACES AT 8'-3".

4" WIDE WHITE STRIPES TYP. AT DESIGNATED WALK

DIAGONAL STRIPES AT 36" O.C.

PATHWAY SHALL PROVIDED 5% MAX SLOPE IN THE DIRECTION OF TRAVEL

PATHWAY SHALL NOT EXCEED 2% CROSS SLOPE

RESTRIPE AND RENUMBER STALLS, TYP.

DETECTABLE WARNING SYSTEM

FLUSH TRANSITION

CROSS SLOPE

PATHWAY SHALL PROVIDED 5% MAX SLOPE IN THE DIRECTION OF TRAVEL

1/16" = 1'-0"
COMPACTED CLASS II AGGREGATE BASE OVER COMPACTED SUBGRADE.

SAWCUT & REMOVE PORTION OF (E) AC PAVING - PROTECT (E) BASE TO PREVENT LOSS OF DENSITY

PRIMECOAT (E) BASE

HOT MIXED ASPHALT PAVING

4" CLASS 2 AGGREGATE BASE

NOTE: MAX. CROSS SLOPE = 2%

CONCRETE WALK/ RAMP SEE SITE PLAN. MEDIUM BROOM FINISH.

# 4 BARS CONT @ TOP AND BOTTOM

1'-0"

4'-0"

1" = 1'-0"

1 1/2" = 1'-0"

NOTE: MAX. CROSS SLOPE = 2%

4" CLASS 2 AGGREGATE BASE

NEW RAMP SECTION

1/2" = 1'-0"

RAMP EDGE

5
RAMP TO AC PAVING
1 1/2" = 1'-0"

RAMP TO (E) WALK
1 1/2" = 1'-0"
FLASHERING AT EYEBROW ELEMENTS
3" = 1'-0"

EAST ELEVATION 2 - AD2
1/8" = 1'-0"

MECHANICAL LOUVER.

PAINTED 20. GA
FLASHING AND COUNTERFLASHING W/ DRIP EDGE SET IN SEALANT

ACM PANEL END CLIP

ANCHOR BOLT PER STRUCTURAL DRAWINGS

DISTRICT OFFICE RETROFIT

EAST ELEVATION AND FLASHING DETAIL

District Office Retrofit

Contra Costa Community College District

PROJECT NO. | DSA FILE NO. | DSA APP. NO. | REFERENCE SHEET NO.
--- | --- | --- | ---
AD2 | A04 | | |
28 WOOD SLAT CUTOUT - AD2

1" = 1'-0"

2"x2" STAINED FINISH TRIM AT 2 1/2" O.C.

1/2" CEMENTITIOUS BACKER BOARD

CERAMIC TILE BULLNOSE TRIM

1/2" GYP. BD., PAINT

STUD FRAMING

1/2" X 2" STAINED FINISH TRIM AT 2 1/2" O.C.

28 WOOD SLAT CUTOUT - AD2

1" = 1'-0"

2"x2" STAINED FINISH TRIM AT 2 1/2" O.C.

1/2" CEMENTITIOUS BACKER BOARD

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1/2" CEMENTITIOUS BACKER BOARD

CERAMIC TILE BULLNOSE TRIM

1/2" GYP. BD., PAINT

STUD FRAMING

1/2" X 2" STAINED FINISH TRIM AT 2 1/2" O.C.
TILE PATTERNS

16

- 1/2" CEMENTITIOUS BACKER BOARD
- CERAMIC TILE AS SPECIFIED
- ALUMINUM TRIM
- RESINOUS FLOORING AS SPECIFIED

11

- 1/2" CEMENTITIOUS BACKER BOARD
- FIELD WALL TILE (CT-1)
- ACCENT TILE (CT-2)
- ACCENT LINER (CT-3)
- EPOXY COVED BASE
- TOP OF FINISH FLOOR
- UNDERSIDE OF FINISH CEILING

AD2

Contra Costa Community College District
District Office Retrofit

1/2" = 1'-0"
3" = 1'-0"

1/2" = 1'-0"
3" = 1'-0"

DATE
REFERENCE SHEET NO.
PROJECT NO.
DSA APP. NO.
DSA FILE NO.

2/19

3" = 1'-0"
PARTIAL DEMOLITION SHEET NOTES

1. CONTRACTOR TO REMOVE AND REPLACE (E) WALL MOUNTED EXTERIOR LIGHT FIXTURE. THE EXISTING FIXTURE CIRCUITRY AND WIRING SHALL BE DEMOLISHED. THE CONTRACTOR SHALL SITE VERIFY FOR EXACT LOCATION OF EXISTING FIXTURE.

2. EXISTING TELEPHONE INTERCOM TO BE REMOVED, DISCONNECT AND REMOVE (E) CABLE BACK TO SOURCE AND DISPOSE ACCORDINGLY.

3. EXISTING CEILING MOUNTED LIGHT FIXTURE TO BE REMOVED AND REPLACED. U,O,N. THE CONTRACTOR SHALL SITE VERIFY FOR EXACT LIGHTING FIXTURE LOCATION. ASSOCIATED J-BOXES AND CONDUITS SHALL BE REMOVED AND DISPOSED ACCORDINGLY. DISCONNECT AND PULL ALL CABLES BACK TO SOURCE AND DISPOSE ACCORDINGLY. COORDINATE DEMOLITION WORK WITH ALL OTHER TRADES.

4. EXISTING POWER AND TEL/DATA OUTLETS TO BE DEMOLISHED. U,O,N. THE CONTRACTOR SHALL SITE VERIFY FOR EXACT OUTLET LOCATIONS. ASSOCIATED J-BOXES AND CONDUITS SHALL BE REMOVED AND DISPOSED ACCORDINGLY. DISCONNECT AND PULL ALL CABLES BACK TO SOURCE AND DISPOSE ACCORDINGLY. COORDINATE DEMOLITION WORK WITH ALL OTHER TRADES.

5. EXISTING AV OUTLETS TO BE DEMOLISHED. U,O,N. ASSOCIATED J-BOXES AND CONDUITS SHALL BE REMOVED AND DISPOSED ACCORDINGLY. DISCONNECT AND PULL ALL CABLES BACK TO SOURCE AND DISPOSE ACCORDINGLY. COORDINATE DEMOLITION WORK WITH ALL OTHER TRADES.

6. EXISTING EXPOSED CONDUIT ALONG WALL TO BE REROUTED AROUND NEW DOOR.

7. EXISTING WALL SCONCE LIGHT FIXTURE TO BE REMOVED.

8. EXISTING WALL MOUNTED LIGHT FIXTURE TO BE RAISED.

9. EXISTING FLOOR BOX RECEPTACLE TO BE DEMOLISHED. REMOVE (E) CABLE BACK TO POWER SOURCE AND DISPOSE ACCORDINGLY.

American Consulting Engineers
Electrical, Inc.

IBI
ARCHITECTURE PLANNING
San Jose
160 W. Santa Clara St., Suite 800
San Jose, California 95113
408.924.0811 fax: 408.924.0844

Contra Costa Community College District
PROJECT NO. DSA FILE NO.
E18030 DSA APP. NO.

E.11

ELECTRICAL DEMOLITION PLAN - FIRST FLOOR
District Office Retrofit

DATE
03/14/2019

AD2
ESK-1

REFERENCE SHEET NO.
**SHEET NOTES**

1. THE CONTRACTOR SHALL COORDINATE WITH ARCHITECTURAL DRAWING TO EXTEND EXISTING "STC" TO FACILITATE NEW WALL / FINISH CONTRACTOR SHALL PROVIDE ALL MATERIALS AS REQUIRED TO EXTEND EXISTING "STC" FOR A CLEAN INSTALLATION.

2. EXISTING LIGHT SWITCH TO REMAIN. THE CONTRACTOR SHALL COORDINATE WITH DISTRICT ELECTRICIAN TO RELOCATE THIS LIGHT SWITCH TO ACCOMMODATE NEW WALL. THE CONTRACTOR SHALL PROVIDE ALL MATERIALS AS REQUIRED TO RELOCATE THIS LIGHT SWITCH TO NEW WALL.

3. EXISTING LOBBY EMERGENCY NOTIFICATION TURN DIAL TO REMAIN. THE CONTRACTOR SHALL COORDINATE WITH DISTRICT ELECTRICIAN TO RELOCATE THIS EMERGENCY DIAL TO ACCOMMODATE NEW WALL. THE CONTRACTOR SHALL PROVIDE ALL MATERIALS AS REQUIRED TO RELOCATE THIS EXISTING LOBBY EMERGENCY NOTIFICATION TURN DIAL TO NEW WALL.
GENERAL NOTES:

1. SEE SINGLE LINE DIAGRAM FOR POWER CONDUCTOR + CONDUIT REQUIREMENTS.

2. SEE DETAIL FOR CONDUIT TRANSITION, CONDUIT PENETRATION, IN-GRADE FULL BOX AND TRENCHING REQUIREMENTS.

3. SEE RISER DIAGRAMS FOR LOW VOLTAGE CONNECTION REQUIREMENTS.

American Consulting Engineers
Electrical, Inc.

IBI ARCHITECTURE PLANNING
San Jose

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

E16890
Exp. 06/30/19

ELECTRICAL DATA PLAN - FIRST FLOOR

District Office Retrofit

Contra Costa Community College District

PROJECT NO. DSA FILE NO. DSA APP. NO. REFERENCE SHEET NO.

AD2 ESK-4 E2.1