PART 1 GENERAL

1.01 SUMMARY

A. Section includes requirements for demolishing, cutting and removing existing construction as designated or required to provide for new work, removal of any construction and obstructions including, but not necessarily limited to, asphalt paving, trees, irrigation systems, fences, fence posts, signs, sign posts, concrete curb, concrete gutters, and concrete slabs in pavement.

1.02 SUBMITTALS

A. Submit a proposed schedule of work items to be performed, and a description of how the work is to be accomplished, for the Owner’s Representative to review.

1.03 PROJECT CONDITIONS

A. Disposition of existing improvements and vegetation:

1. All materials indicated to be removed shall become the property of the Contractor and shall be disposed of by him, outside of the project site. Contractor shall not dispose of removed materials by sale, gift or any other manner to the general public, at the site; provided, however, that this provision shall not be construed as limiting or prohibiting sale or disposal of such materials at the site to duly licensed contractors or material men, provided materials are removed from construction by the Contractor.

2. All removal of debris from the site, including removal of inventory to site of storage, is part of this contract and shall be done by Contractor’s employees and no others.

B. Where units or items of existing work are designated to be removed and reused in the new work or are to become salvage, remove such units or items carefully; use tools and methods which will not damage such units or items; protect underlying or adjoining work from damage. Such items shall be cleaned by the contractor.

C. Erect and maintain temporary bracing, shoring, lights, barricades, except construction barricades for new construction, warning signs, and guards necessary to protect public, the Owner’s employees, finishes, improvements to remain and adjoining property from damage, all in accordance with applicable regulations.

D. Scheduling:

1. Coordinate with the Owner in scheduling noisy or dirty work.
2. Schedule work at the Owner’s convenience to cause minimal interference with the Owner’s normal operations.

E. Traffic Circulation: Maintain emergency vehicle access to campus. Ensure minimum interference with roads, streets, driveways, sidewalks, and adjacent facilities. Do not close or obstruct public thoroughfares without first obtaining permission from Diablo Valley College and City of Pleasant Hill. Where closing of a vehicular or pedestrian traffic circulation route is necessary, provide adequate directional signs to minimize the potential for confusion. Traffic Plans may be required by the City of Pleasant Hill should closures or diversions be required. Also coordinate any route closures and rerouting with the Contra Costa Fire Protection District, campus security forces and campus Buildings and Grounds.

PART 2 EXECUTION

2.01 EXAMINATION

A. Examine areas in which work is to be performed. Report in writing to the Owner’s Representative all prevailing conditions that will adversely affect satisfactory execution of work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Arrange for and verify termination of utility services or irrigation, and capping of lines, if any. Do not turn off any utility, communication, or irrigation services without providing for temporary or permanent maintenance of service to ongoing operating campus facilities. Coordinate all shut downs and reconnects with Owner, and affected utility companies.

C. Starting work constitutes acceptance of the existing conditions and the Contractor shall then, at his expense, be responsible for correcting all unsatisfactory and defective work encountered.

2.02 CLEARING

A. Remove any trees or tree limbs, shrubs, bushes, vines, and rubbish that interferes with paving operation; obtain verification from Owner’s Representative if trees are affected.

2.03 GRUBBING

A. Provide noise and dust abatement as required to prevent contamination of adjacent areas. Remove all materials not designated as salvage, in their entirety.

B. Remove existing pavement within proposed pavement areas to a depth sufficient to allow for the construction of the proposed pavement to the grades shown. Existing base material may be left in place and re-compacted as required where not conflicting with the new pavement section.

2.04 REMOVAL

A. General:
1. Remove materials in an orderly and careful manner.
2. Repair or replace all removal work performed in excess to that required at no cost to the Owner. Repair or replacement shall match and equal construction, condition and finish existing at time of award of Contract.

B. Remove following from locations to the extent required or directed for new construction. Removal of slabs and other structures shall include their footings and foundations. Removal of pavements shall include base rock and sub-structures.

1. Asphalt pavement, and concrete curbs, gutters, and slabs.
2. Miscellaneous structural elements which interfere with the new construction and as directed by the Owner's Representative.

C. Cutting asphalt, concrete curb and concrete pavement:

1. All lines shall be marked and accepted by Owner's Representative before the cutting operation.
2. Cut edges of pavement at 90-degree angle to the surface in a true and straight line in accordance with dimensions shown on the Drawings. Make cuts with a concrete saw, to a 2" minimum depth.

D. Backfill and compact areas excavated and open pits and holes resulting from removal operations. Comply with requirements specified in Earthwork, Section 02200 for backfill materials, compaction and installation methods.

2.05 CLEANUP AND DISPOSAL

A. Transport trash, rubbish and debris daily from site and legally dispose of.

1. Remove and promptly dispose of contaminated, vermin-infested and dangerous materials encountered.
2. Do not burn or bury materials on site.

B. Clean excess soil may be distributed on site as accepted by Owner's Representative, if it does not adversely affect specified finish grades.

C. Upon completion of work under this Section, remove all tools, equipment and temporary enclosures and structures.

2.04 FIELD QUALITY CONTROL

A. The Owner's Representative will accompany the Contractor before and after performance of work to confirm physical condition of improvements involved.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavation including removal of known on- or below-grade construction or obstructions, and filling and backfilling.

B. Definitions:

1. Compaction: Ratio expressed as percentage of dry density of material compacted in field to maximum dry density of same material as determined by ASTM D1557.

1.02 REFERENCE STANDARDS

A. Standard Specifications, May 2010, issued by California Department of Transportation (CSS).


1.03 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Work shall comply with rules and regulations of local and State agencies having jurisdiction.

2. State and local code requirements shall control disposal of debris.

B. Allowable Tolerances:

1. Excavations shall not exceed 1/10-foot variation from dimensions and elevations shown or noted.

2. Fill and backfill shall be placed within tolerance of plus or minus 1/10-foot.

3. Pay costs for additional inspections and tests due to noncompliance with Contract Documents.

1.04 JOB CONDITIONS

A. Existing Conditions:
1. Carefully maintain bench marks, monuments, and survey control references.
2. Verify or determine locations of underground utilities and avoid damage. Should damage occur, notify the District’s Representative, and repair at no additional cost to the Contract.
3. Restore grades disturbed by construction activity or other causes to elevations shown or noted.

B. Environmental Requirements: When unfavorable weather conditions necessitate interrupting grading operations, prepare areas by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, re-establish compaction specified in last layer before resuming work.

C. Protection: Conduct earthwork operations so as to prevent windblown dust and dirt from interfering with the Owner’s and adjacent property owner’s normal operations. Assume liability for all claims related to windblown dust and dirt. Protect building structures and adjacent surfaces to remain.

D. Sequencing: Sequence operations so as to maintain safe working conditions and preserve existing Work which is to remain.

PART 2 PRODUCTS

2.01 MATERIALS

A. Granular Backfill: Class II aggregate base per CSS Section 26, ¾-inch maximum size.

PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall be deemed to have inspected site and informed himself of actual grades, levels, and other conditions under which Work is to be performed.

3.02 EXCAVATION

A. General Requirements:
   1. Excavate to dimensions and elevations shown or noted with bottoms square and true.
   2. Remove debris, old concrete, tree roots, and loose rocks from bottom of excavation.

B. Excavated Soil Material: All excavated material determined unsuitable for use as fill or backfill or in excess of backfill requirements shall be removed from the site.

3.03 FILLING AND BACKFILLING
A. General Requirements:

1. Do not place fill or backfill until rubbish and deleterious materials have been removed, and areas have been approved by the District Representative.
2. Scarify surface of area to receive fill to 6-inch depth and until surface is free from ruts, hummocks or other uneven features. Disc or blade scarify surface until free from large clods.
3. Bring scarified material to proper moisture content and compact to specified density.
4. Place granular backfill material as adjacent backfill is being placed.

B. Minimum Compaction Requirements:

1. Subgrade under pavements supporting automobile traffic: 95-percent
2. Subgrade under sidewalks and walkways: 90-percent
3. Do not compact soil in planting areas.

C. Compacting:

1. Compact by rolling. Scarify and recompact any layer not attaining compaction until required density is obtained.
2. Compaction by flooding, ponding or jetting will not be permitted.

3.04 FIELD QUALITY CONTROL

A. The Owner’s Geotechnical Engineer may:

1. Sample and test fill material from source designated by the Contractor.
2. Observe site preparation, excavation and placing and compacting of fill and backfill.
3. Perform tests and inspections deemed necessary to ensure compliance with specifications.
4. Issue final report to the Owner on grading and certification of compliance with specifications.

END OF SECTION
SECTION 02512

ASPHALT CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. The extent of the asphalt concrete paving work including depths of the pavement section is shown on the drawings. This Section describes:

1. Aggregate base

1.02 REFERENCE STANDARDS

A. Standard Specifications, latest edition, issued by California Department of Transportation (CSS).


1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or meeting CSS requirements.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements local DOT for asphalt paving work.

1.04 PROJECT CONDITIONS

A. Prior to placing asphalt concrete, or placing aggregate base, all underground utilities and drainage systems shall be installed, backfill completed and the utility installations have satisfactorily passed acceptance tests by Owner Representative.

B. Environmental Requirements: Do not place asphaltic concrete when atmospheric temperature is below 50 degrees Fahrenheit or when weather conditions are unsuitable to material being placed.
PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate Base: CSS Section 26, ¾-inch maximum size.

B. Binder: Emulsified asphalt diluted with water, CSS Section 94, Type SS1.

C. Hot mix asphalt (HMA): CSS Section 39, Type A using aggregate with 1/2 inch maximum, medium grading or such other grading as shown on the drawings, and steam refined paving asphalt meeting requirements for AR 4000 of CSS Section 92.

2.02 STORING, PROPORTIONS AND MIXING

A. Asphalt concrete materials shall be stored, proportioned and mixed in accordance with CSS Section 39-3.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive asphaltic concrete and verify following:

1. That related work such as drainage structures, grates, frames, curbs, headers, and adjacent paving have been set at proper elevations or that conditions will permit adjustment to proper elevations.

2. Absence of wet receiving surfaces or other conditions that adversely affect execution of this work.

B. Do not start work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Subgrade: Prepare subgrade in accordance with the requirements of Section 31 20 00. Ensure receiving areas are true to line and grade, dry, firm, properly prepared, and free from loose or foreign material.

B. Do not proceed until subgrade has been inspected and approved by the Owner's Representative.
3.03 CONFORM PAVING

A. Asphalt Pavement: Saw cut perimeter at conform and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Placing Asphalt Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

D. Pavement Lifts: 4" inch total thickness, consisting of two equal lifts.

E. Compaction: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

F. Existing Asphaltic Concrete Paving:

1. Repair damage caused by construction operations and restore to condition prior to construction.

2. Restoration may be accomplished by patching defects, resurfacing, completely replacing, or combination of these measures, but measures taken shall be adequate for work of restoration required and shall be subject to the Engineer's approval.

G. Bituminous concrete paving shall show no evidence of cracking, uneven settlement or improper drainage, improper drainage or untoward junctions with adjoining or existing asphaltic concrete surfaces. Correct work displaying such conditions under the Contractor's warranty of all work.

H. Finish surface shall be true to established elevations within 1/4 inch in ten feet as measured from a 10-foot straight edge in any direction.

3.04 FIELD QUALITY CONTROL

A. The Owner's Representative may engage inspector(s) to be present at job site and batch plant for sampling, testing and inspections.
B. Where pavement surface slopes are less than 1.5% water test pavement to insure that no ponding occurs and that the water runs to the drainage facilities indicated on the plans. If ponding occurs, the contractor must repair pavement as necessary to insure complete runoff of surface water.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

The Contractor shall:

1. Furnish access to site and facilities for inspection.
2. Pay costs for additional inspections and tests due to noncompliance with Contract Documents.

3.05 WASTE HANDLING

A. General: Disposal of asphalt-paving waste must be done in accordance with State and Local requirements. Asphalt-paving waste materials must be legally disposed off of Owner's property, at no cost to Owner.

3.06 PROTECTION

A. Permit no surface traffic until surface has cooled sufficiently to resist damage.

END OF SECTION
SECTION 02520
SITE CONCRETE

1.01 SUMMARY

A. This Section describes the requirements for materials, fabrications and installation of:
   1. Concrete sidewalks (pathways), curbs, and accessibility ramps (including detectable warning surfaces).
   2. Formwork for walks, curbs, etc.

B. Related Sections of Work
   1. Asphalt concrete pavement: Section 02512

1.02 REFERENCES

A. Standard Specifications, latest edition, issued by California Department of Transportation (CSS).


1.03 DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered to the jobsite in the manufacturer’s original and unopened containers that bear labels showing type of material. Package finished surfaces with protective wrappings to protect panels from residue before and during installation.

B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Detectable Warning Surfaces: Submit manufacturer’s descriptive data, color and texture samples, and installation instructions for approval. Submit 2 samples of both the “cast in place” and “glue down” tiles, a minimum of 6” x 6”.

Contra Costa Community College District
Diablo Valley College
D-1038 Stubbs Road / Viking Drive Access Pathways
1.05 QUALITY ASSURANCE:

A. Standards: All work shall be in accordance with latest edition standards and specifications of the American Society for Testing and Materials (ASTM), California Department of Transportation (CALTRANS) Standard Specifications (CSS) and local requirements where they may apply.

B. Damage and Repair: Prevent damage to adjacent concrete curbs, walks, etc., during installation. Repair any damage to concrete edges or breaks in concrete at no cost to the Owner, by removal and replacement of complete sections. Patching will not be acceptable.

C. Contractor shall be completely responsible for the determination of concrete mixes to provide compressive strength and other requirements set forth under this Section.

D. Samples shall be supplied as required for testing.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 40; deformed.

B. Dowel Bars: ASTM A 615/A 615M, Grade 40 plain-steel bars. Cut bars true to length with ends square and free of burrs.

2.02 CONCRETE STRENGTH AND USAGE:

A. Sidewalk and Curb Concrete: Concrete and materials therefor shall conform to the applicable requirements for minor concrete in CSS Section 73 Concrete Curbs and Sidewalks and Section 90 Portland Cement Concrete.

2.03 RELATED MATERIALS

A. Joint Fillers: preformed cork strips complying with ASTM D 1752, or preformed sponge rubber strips complying with ASTM D1752.

2.04 FORMS:

A. Sidewalk (Pathway): Sidewalk forms shall be of wood or steel, straight and of sufficient strength to resist springing during depositing and consolidating concrete, and of a height equal to the full depth of the finished sidewalk. Wood forms shall be surfaced plank, two-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects.
Wood forms shall have a nominal length of 10 feet, with a minimum of three stakes per form, at maximum spacing of four feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Form ends shall be interlocked and self-aligning. Forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Forms shall have a nominal length of 10 feet, with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips, designed for use with steel forms.

B. Curb:

1. Conform to the requirements specified for sidewalk forms.

2. Rigid forms shall be provided for curb returns, except that benders of thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.

2.5 DETECTABLE WARNING SYSTEMS:

A. The detectable warning surface must comply with the following regulations:

1. Americans with Disabilities Act (ADA) Title III Regulations, 28 CFR Part 36 "ADA Standards For Accessible Design," Appendix A, Section 4.29 for "Detectable Warnings."

2. Division of the State Architect - Access Compliance (DSA-AC) approved detectable warning products as provided in the California Code of Regulations (CCR) Title 24, Part 2, Section 205 definition of "Detectable Warning."

B. Acceptable Manufacturers are (subject to conformance with the plans and Special Provisions): ADA Solutions, Answer Industries, Armor-Tile, or approved equal.

C. Adhesives, Fasteners, and Sealant shall conform to the manufacturers recommendations.

D. Vitrified polymer composite with aluminum oxide particles imbedded on truncated domes; homogeneous coloring. Conform to the following performance requirements:
### Property Value Test Methods

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Test Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength</td>
<td>Not less than 28,000 psi</td>
<td>ASTM D695</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>Not less than 11,000 psi</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>Not less than 25,000 psi</td>
<td>ASTM D790</td>
</tr>
<tr>
<td>Fire Resistance</td>
<td>Flame spread shall be less than 15</td>
<td>ASTM E84</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>Not to exceed 0.07%</td>
<td>ASTM D570</td>
</tr>
<tr>
<td>Slip Resistance</td>
<td>The combined Wet and Dry Static Co-Efficient of Friction not to be less than 0.80 on top of domes and field area</td>
<td>ASTM C1028</td>
</tr>
</tbody>
</table>

### PART 3 - EXECUTION

#### 3.01 SUBGRADE PREPARATION

A. Sidewalk (Pathway) Subgrade: The subgrade shall be thoroughly wetted and then compacted to required density. The completed subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

B. Curb and Gutter Subgrade: The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement and shall be placed and compacted. The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter.

C. Maintenance of Subgrade: The subgrade shall be maintained in a smooth, compacted condition, in conformity with the required section and established grade until the concrete is placed. The subgrade shall be prepared and protected so as to produce a subgrade free from frost when the concrete is deposited.

#### 3.02 FORM SETTING

A. Sidewalk (Pathway): Forms for sidewalks shall be set with the upper edge true to line and grade and shall be held rigidly in place by stakes. After forms are set, grade and alignment shall be checked with a 10-foot straightedge. Forms shall conform to line and grade with an allowable tolerance of 1/4 inch in any 10-foot long section. Forms shall have a transverse slope with the low side adjacent to the roadway unless otherwise indicated. Forms shall be coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory. Side forms shall not be removed within 12 hours after finishing has been completed.
B. Curbs: Forms for curbs shall be carefully set to alignment and grade and to conform to the dimensions of the curb. Forms shall be held rigidly in place by the use of stakes. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. The forms on the front of the curb shall be removed not less than two hours nor more than six hours after the concrete has been placed. Forms at back of curb shall remain in place until the face and top of the curb have been finished as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.03 CONCRETE PLACEMENT AND FINISHING

A. Concrete shall be placed in the forms in one layer of such thickness that when compacted and the finished sidewalk will be of the thickness indicated. Moisten subbase to provide a uniform dampened condition at time concrete is placed. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be tamped and consolidated with a suitable wood or metal tamping bar, and the surface shall be finished to grade with a wood float. Finished surface of the walk shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Irregularities exceeding the above shall be satisfactorily corrected. The surface shall be divided into rectangular areas by means of contraction joints spaced at intervals equal to the width of the sidewalk or 15 feet, whichever is less. After straight edging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic.

Surface Uniformity: The completed surface shall be uniform in color and free of surface blemishes and tool marks.

B. Curb and Gutter Concrete: Concrete shall be placed and thoroughly consolidated by tamping and spading or with approved mechanical vibrators.

3.04 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness.


3.05 DETECTABLE WARNING SURFACE INSTALLATION

A. Prefabricated truncated dome panels shall be the cast in place type for new curb ramps, and shall be the glue down type for existing curb ramps and existing surface applications. Dimensions and spacing must be as shown on the plans.

B. Contractor shall install securely and conform to the manufacturer's printed instructions for installation.

3.06 BACKFILLING AND PROTECTION

A. Backfilling: After curing, debris shall be removed, and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

C. Protection: Completed concrete shall be protected from damage until accepted. Repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Remove damaged portions and dispose of as directed.

3.07 GUARANTEE

A. Cast in place and glue down tactile tiles shall be guaranteed in writing by the Contractor for a period of five years. The guarantee includes defective work, breakage, deformation, and loosening of tiles. Begin guarantee period upon final acceptance of all improvements from the Owner.

B. The manufacturer must provide a written 5-year warranty for detectable warning surfaces, guaranteeing replacement when there is a defect in the dome shape, color fastness, sound-on-cane acoustic quality, resilience, or attachment. Begin warranty period upon final acceptance of all improvements from the Owner.

END OF SECTION
SECTION 02580

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section describes the requirements for traffic striping, pavement symbols and markings

B. Related Sections of Work

1. Asphalt concrete pavement: Section 02512

1.02 REFERENCES

A. Standard Specifications, issued by California Department of Transportation dated May 2010, (CSS).


1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged products in original containers with seals unbroken and labels intact until time of installation.

B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Paint for traffic stripes and pavement markings shall conform to Section 84-3 of CSS, except that 30 mesh Monterey sand may be substituted for glass beads.

B. Thermoplastic Traffic Markings and Pavement Marking shall conform to Section 84-2 of CSS, and shall be installed at locations indicated of the Project Plans.

PART 3 - EXECUTION

3.01 INSPECTION

Contra Costa Community College District
Diablo Valley College
D-1038 Stubbs Road / Viking Drive Access Pathways
A. Examine receiving surfaces and verify that surfaces are proper and ready for installation.
B. Do not start work until unsatisfactory conditions have been corrected.

3.02 APPLICATION

A. Where shown on Drawings, remove existing pavement markings by carefully sandblasting marking material from pavement surface, taking care not to leave "ghosts" of original layout.
B. Apply marking paint in accordance with approved manufacturer's recommendations.
C. Assure dense coverage such that color and texture of substrate is not visible.
D. Parking Stripes: Paint four inches wide unless otherwise noted.
E. Symbol Marking: Paint as shown on Drawings.
F. Non-Slip Additive: Apply while paint is wet, between coats.

3.03 CLEANING

A. Upon completion of work, remove surplus materials, rubbish and clean off spilled or splattered paint resulting from this work.

3.04 PROTECTION

A. Permit no surface traffic until pavement and symbol marking has dried thoroughly.

END OF SECTION
SECTION 02581

PARKING BUMPERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section describes the requirements for materials, fabrication and installation of parking bumpers and associated accessory items.

B. Related Sections of Work

1. Asphalt concrete pavement: Section 02512
2. Pavement Markings: Section 02580

1.02 REFERENCES

A. Standard Specifications, issued by California Department of Transportation dated May 2010, (CSS).


1.03 SUBMITTALS

A. Manufacturer’s literature describing products.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Parking Bumpers: Precast reinforced concrete with minimum compressive strength of 3500 psi at 28 days, white color.

B. Steel pins as recommended by approved bumper manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine receiving surfaces and verify that surfaces are proper and ready for installation.

B. Do not start work until unsatisfactory conditions have been corrected.
3.02 INSTALLATION

A. Install parking bumpers in accordance with manufacturer's recommendations using fasteners noted.

END OF SECTION
SECTION 02810
IRRIGATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Piping.
   2. Automatic Control Valves.
   4. Quick Couplers.
   5. Boxes for automatic control valves.

1.2 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

C. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Zoning Chart: Show each irrigation zone and its control valve.
1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

   1. PVC Socket Fittings: ASTM D 2466, Schedules 40 and 80.
   2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
   3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

2.2 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 AUTOMATIC CONTROL VALVES

A. Automatic Control Valves:
   1. Manufacturers: per Drawing.
   2. Description: Normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

2.4 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:
1. Manufacturers: per Drawing

2.5 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:
   1. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
      a. Size: As required for valves and service.
      b. Box Manufacturer: Brooks, or as specified on plans
      c. Lid Manufacturer: Sipra Corp 888-775-5543, or as specified on plans.
      d. Lid Model: Lockjaw Lid, or as specified on plans
   2. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum, or as specified on plans.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

B. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches, to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

C. Provide minimum cover over top of underground piping according to the following:
   1. Irrigation Main Piping: Minimum depth of 18 inches below finished grade.
   2. Circuit Piping: 12 inches.
   3. Drain Piping: 12 inches.

D. Refer to Irrigation Legend for additional information.

3.2 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.
F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.

G. Install underground thermoplastic piping according to ASTM D 2774.

H. Install expansion loops in control-valve boxes for plastic piping.

I. Lay piping on solid subbase, uniformly sloped without humps or depressions.

J. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

K. Refer to Irrigation Legend for additional information.

### 3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   3. PVC Nonpressure Piping: Join according to ASTM D 2855.

D. Refer to Irrigation Legend for additional information.

### 3.4 VALVE INSTALLATION

A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.

### 3.5 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

B. Install sprinklers at manufacturer's recommended heights.

C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.

D. Refer to Irrigation Legend for additional information.
3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Any irrigation product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Refer to Irrigation Legend for additional information.

3.7 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.8 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Underground irrigation main piping shall be the following:
   1. Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.

C. Circuit piping shall be the following:
   1. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.

D. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.
   1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

E. Refer to Irrigation Legend for additional information.
END OF SECTION 02810
SECTION 02831
GALVANIZED CHAIN LINK FENCING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Fence framework, fabric and accessories.
B. Installation

1.02 SUBMITTALS
A. Shop drawings: Layout of fences with dimensions, details, and finishes of components, accessories, and post foundations, if required.
B. Product data: Manufacturer's catalog cuts indicating material compliance and specified options. Fabric shall be “green vinyl coated”.
A. Samples: If requested, samples of materials (e.g., fabric, wires, color, and accessories).

1.03 REFERENCES
A. Standard Specifications, issued by California Department of Transportation dated May 2010, (CSS).

PART 2 PRODUCTS

2.01 CHAIN LINK FENCE FABRIC
A. Green vinyl coated galvanized wire: Galvanized fabric shall be galvanized after weaving with a minimum of 1.2 ounces of zinc per square foot of surface area and conform to ASTM A 392, Class 1.
B. Size: Fabric shall be 9-gage wire woven in a 2-inch diamond mesh.
C. Selvage of fabric knuckled at top and knuckled at bottom.
2.02 STEEL FENCE FRAMING

A. Steel pipe - Type I: ASTM F 1083, standard weight schedule 40; minimum yield strength of 25,000 psi; sizes as indicated. Hot-dipped galvanized with minimum average 1.8 oz/ft² of coated surface area.

B. End and Corner Post: see project plans
   Line (intermediate): see project plans
   Rail and Braces: see project plans

2.03 ACCESSORIES (painted green by manufacture)

A. Chain link fence accessories: [ASTM F 626] Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

B. Post caps: Formed steel, cast malleable iron, or aluminum alloy weathertight closure cap for tubular posts. Provide one cap for each post. Provide tops to permit passage of top rail.

C. Top rail and brace rail ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.

D. Top rail sleeves: 7” expansion sleeve with spring, allowing for expansion and contraction of top rail.

E. Wire ties: 9 gauge [0.148"] galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge [0.092"] for rails and braces. Hog ring ties of 12-1/2 gauge [0.0985"] for attachment of fabric to tension wire.

F. Brace and tension (stretcher bar) bands: Pressed steel. At square post provide tension bar clips.

G. Tension (stretcher) bars: Install per manufacturer’s recommendations.

H. Tension wire: Galvanized coated steel wire, 7 gauge, [0.177"] diameter wire with tensile strength of 75,000 psi.

I. Truss rods & tightener: Steel rods with minimum diameter of 5/16”. Capable of withstanding a tension of minimum 2,000 lbs.

J. Nuts and bolts are galvanized.

2.04 SETTING MATERIALS

A. Concrete: Minimum 28 day compressive strength of 3,000 psi.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify areas to receive fencing are completed to final grades and elevations.

B. Ensure property lines and legal boundaries of work are clearly established.

C. Arrange for and verify that underground utilities have been marked.

3.02 CHAIN LINK FENCE FRAMING INSTALLATION

A. Install chain link fence in accordance with ASTM F567, "Standard Practice for Installation of Chain-Link Fence", and manufacturer's instructions.

B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30° or more.

C. Space line posts uniformly as noted on plans.

D. Concrete set terminal posts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter 4 times greater than outside dimension of post, minimum 12” dia. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Spoils not used to fill holes from the removal of existing fence shall be removed from site. Place concrete around posts in a continuous pour. Trowel finish around post. Slope to direct water away from posts.

E. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

F. Bracing: Install horizontal pipe brace at mid-height on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Adjust truss rod, ensuring posts remain plumb.

G. Tension wire: Provide tension wire at bottom of fabric. Install tension wire before stretching fabric and attach to each post with ties. Secure tension wire to fabric with 12-1/2 gauge [0.0985"] hog rings 24” on center.

H. Top rail: Install lengths, 21’. Connect joints with sleeves for rigid connections for expansion/contraction.
3.03 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on field side of posts except where indicated on plans and attach so that fabric remains in tension after pulling force is released. Leave no space between finish grade and bottom selvage. Attach fabric with wire ties to line posts at 15” on center and to rails, braces, and tension wire at 24” on center.

B. Tension (stretcher) bars: Pull fabric taut; fasten to posts per manufacturer’s recommendations.

3.04 ACCESSORIES (painted green by manufacture)

A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.

B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

3.05 CLEANING

A. Clean up debris and unused material, and remove from the site.

END OF SECTION
SECTION 02920

LAWNS AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Seeding.
   2. Sodding.

1.2 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.
1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Certification of grass seed.
   1. Certification of each seed mixture for turfgrass sod.

B. Product certificates.

1.5 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   1. Pesticide Applicator: State licensed, commercial.

B. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
   1. Report suitability of tested soil for turf growth.
      a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
      b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

1.7 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is
planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: 90 days from date of Substantial Completion.
2. Sodded Turf: 90 days from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: State-certified seed of grass species as follows:

1. Sun and Partial Shade: Proportioned by weight as follows:
   a. 90% percent Tall Fescue Blend and 10% Kentucky Bluegrass

2.2 TURFGRASS SOD

A. Sod shall be a sport turf variety with high drought and heat tolerance consisting of 90% Tall Fescue and 10% Kentucky Bluegrass with biodegradable netting. Available through Delta Bluegrass, 1-800-637-8873, www.deltabluegrass.com, or approved equal.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.
B. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches of soil. Till soil to a homogeneous mixture of fine texture.
   a. Apply fertilizer directly to surface soil before loosening.
3. The following recommendations are for bid purposes only. Contractor shall follow recommendations of soil testing lab. For all planting areas:
   a. organic amendment: 6 cubic yards/1,000 sf
   b. fertilizer: type a (6-20-20) at 20 lbs./1,000 sf
   c. iron sulfate: 10 lbs./1,000 sf
   d. soil sulfur: 15 lbs/1,000 sf
4. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
5. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

A. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 4 to 6 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
3.3 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.4 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.

C. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer’s written recommendations. Coordinate applications with Owner’s operations and others in proximity to the Work. Notify Owner before each application is performed.

3.5 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.
END OF SECTION 02920
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SECTION 02930

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plants.
   2. Planting soils.

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

F. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

G. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

H. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

I. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
J. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

K. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.5 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

1. Pesticide Applicator: State licensed, commercial.

B. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.

1. Report suitability of tested soil for plant growth.
   a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
   b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

D. Preinstallation Conference: Conduct conference at Project site.

E. Refer to "Landscape Notes" on plans for additional information.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape.
Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

B. Handle planting stock by root ball.

C. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1.7 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
   b. Structural failures including plantings falling or blowing over.

2. Warranty Periods from Date of Substantial Completion:
   a. Trees: 12 months.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period for Trees: Three months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated
when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

C. Refer to “Landscape Notes” on plans for additional information.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

B. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

C. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
D. Manure: Well-rotted, unbleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 6 cy/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 10-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.5 PLANTING SOILS

A. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

B. Refer to "Landscape Notes" on plans for additional information.
2.6  MULCHES

A. Organic Mulch: “Walk-On” fir bark mulch ½” – ¾” diameter.
B. See “Landscape Notes” on plans for additional specifications.

2.7  PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1  EXCAVATION FOR TREES

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately two times as wide as ball diameter.
2. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

B. Subsoil and topsoil removed from excavations may be used as planting soil.

3.2  TREE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
C. Set stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Use planting soil for backfill.
2. Container-Grown: Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Refer to “Landscape Notes” on plans for additional information.

3.3 TREE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

3.4 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees in Turf Areas: Apply organic mulch ring of 4-inch average thickness, with 24-inch radius around trunks or stems. Do not place mulch within 2 inches of trunks or stems.

3.5 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.

D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION 02930
PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Steel pipe railings.
   2. Stainless Steel Pipe Railings.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

   1. Handrails:
      a. Uniform load of 50 lbf/ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.

   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
      b. Infill load and other loads need not be assumed to act concurrently.
      c. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Grout and anchoring cement.
   2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.04 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a

Contra Costa Community College District
Diablo Valley College
D-1038 Stubbs Road / Viking Drive Access Pathways
qualified testing agency, according to ASTM E 894 and ASTM E 935.

PART 2 – PRODUCTS

2.01 STEEL

A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40).

2.02 MISCELLANEOUS MATERIALS

A. Post-Installed Anchors: Chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.


F. Stainless steel railings and hardware, if specified by owner shall be installed, welded and treated per the manufacturer’s recommendations.

2.03 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
5. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
6. Form changes in direction by bending or by inserting prefabricated elbow fittings.
7. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.

2.04 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot-dip galvanize steel and iron railings, including hardware, after fabrication.
   2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.

B. Stainless steel railings and hardware, if specified by owner shall be installed, welded and treated per the manufacture's recommendations.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

   1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Anchor posts in concrete by inserting into formed or core-drilled hole and grouting annular space.

3.02 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

B. Stainless steel, if used, per manufactures specifications.

END OF SECTION
SECTION 10441

TRAFFIC SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section describes the requirements for installing signs and sign posts in conformance with the details shown on the contract and standard plans.

1.02 REFERENCES

A. Standard Specifications, issued by California Department of Transportation dated May 2010, (CSS).


1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged products in original containers with seals unbroken and labels intact until time of installation.

B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Signs shall be fabricated and furnished in accordance with details shown on the plans, the Traffic Sign Specifications, and these special provisions. Traffic Sign Specifications for California sign codes are available for review at:
   http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm

B. Traffic Sign Specifications for signs referenced with Federal MUTCD sign codes can be found in Standard Highway Signs Book, administered by the Federal Highway Administration, which is available for review at:

C. Information on cross referencing California sign codes with the Federal MUTCD sign codes is available at:
   http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm
D. Reflective sheeting shall be Scotchlite brand high intensity grade or approved equal.

E. Vendors shall present proof that the type of reflective sheeting they intend to use has been used on highway signs located on California highways for a period of at least two years and has proven entirely satisfactory to the State.

F. Bolts, Nuts and Washers shall conform to Contra Costa County Standard Detail CRS1i and Section 55-2, "Materials" in the CSS, and shall be galvanized after fabrication.

G. Sign posts shall be 2 3/8" O.D. galvanized iron pipe. Wood posts or square metal posts will not be allowed. Top of metal posts shall be "capped".

H. Concrete for foundations shall conform to Section 90-10, “Minor Concrete” of the CSS.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine receiving surfaces and verify that surfaces are proper and ready for installation. The finished signs shall be clean and free from all roulher chatter marks, burrs, sharp edges, loose rivits, delaminated reflective sheeting and aluminum marks. Signs with any defects or damage that would affect their appearance or serviceability will not be accepted. No repairs shall be made to the face sheet without approval of the District. All signs not conforming in all respects to the requirements of these specifications will be rejected and replaced at the Contractor's cost.

B. Do not start work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Roadside signs shall be furnished and installed at the locations shown on the plans or where designated by the District.

B. The Contractor shall pothole, locate, and verify the depth of adjacent utilities prior to excavating for the posthole foundation.

C. Signs shall be mounted at the height specified on the plans meeting DSA code requirements.

END OF SECTION
SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions and Division 1, General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK

A. Related Work in Other Sections

1. Painting of exposed electrical work.

B. Work Included in Contract

1. Provide and install new campus 277/480V, 3 phase, 4 wire and 120/208V, 3 phase, 4 wire electrical distribution system with new transformer and weatherproof enclosures for a complete system as detailed on drawings.

2. Provide and install new bollard lighting, bases and power as shown on drawings.

3. Provide and install new timeclock for lighting control as specified on drawings.

4. Grounding per NEC.

1.03 CODES AND STANDARDS

A. In addition to Codes and Standards - Division 1, the following shall apply to this Division:

   National Electrical Code
   U.L. Electrical Construction Materials List
   Codes, rules and regulations as specified hereinafter
   Local city and county agencies
   Uniform Building Code
1.04 SUBMITTALS

A. Submittals shall be made in conformance with the General Conditions. The list shall include, for each item, the manufacturer, manufacturer's catalog number, type of class, the rating, capacity, size, etc. Submittals shall include:

1. Conduit & Fittings
2. Boxes & Covers
3. Time Switches
4. Wiring Devices
5. Wire & Cable
6. Transformer
7. Panelboards
8. Disconnect Switches
9. Lighting

B. Shop Drawings: Submit for approval, detailed construction drawings for each item of fabricated equipment required for the electrical installation. All drawings shall be to scale, fully dimensioned, and provide sufficient detail to clearly indicate the arrangement of the equipment and its component parts. Construction of the equipment shown shall be revised to comply with the drawings and specifications as required by the Architect after review of the shop drawings, and the drawings submitted when requested by the Architect. Shop drawings shall be submitted for the following:

1. N/A

C. Substitution: Provide substitutions as outlined in Section 01630.

1.05 SUPERVISION OF ELECTRICAL WORK

A. Contractor shall personally, or through an authorized and competent representative, constantly supervise the work from beginning to completion and final acceptance. So far as possible, keep same foreman and workmen throughout the project duration. Work shall be subject to inspection and approval by Architect. Promptly furnish related information when so requested by Architect.

1.06 EQUIPMENT AND SYSTEMS IDENTIFICATION

A. Name Plates: Provide permanent identification of circuit breakers in switchboards, panels, transformers, disconnects for mechanical and plumbing roof-top equipment and other cabinet
enclosed apparatus. Use black bakelite plates, not less than \( \frac{1}{2} \times 3 \)", with engraved white letters, secured with adhesive. Provide voltage along with panel name. Provide red with white letters on FACP, FATC, etc.

B. Stencil Work: Identify all motors and operating apparatus in electrical equipment rooms or semi-concealed spaces, with black or white lacquer lettering, not less than \( \frac{1}{2} " \) high, placed where readily visible upon inspection.

C. Directories: Provide for power circuits, typewritten, neatly arranged in numerical order, and permanently fixed inside or adjacent to appropriate panel.

D. Provide lamecoid label on all receptacle and switch covers indicating complete circuit number.

E. Provide service description etched on cover of all underground pull boxes.

1.07 OPERATING INSTRUCTIONS ON-SITE

A. At time of occupancy, arrange for manufacturer's representatives to instruct building operating and maintenance personnel in use of any equipment requiring operating and maintenance. Arrange for all personnel to be instructed at one time. Pay all costs for such service (minimum of 4 hours).

1.08 ADJACENT WORK

A. Coordinate work and complete with others in furnishing and placing this work.

B. Work to approved shop drawings for work by others and to field measurements as necessary to properly fit the work.

C. Project adjacent work as necessary; adjacent construction or exposed surfaces or surfaces damaged by use of materials or operations under this Section shall be repaired or replaced as directed by Architect.

1.09 DRAWINGS

A. The electrical drawings, which constitute an integral part of this contract, shall serve as the working drawings. They indicate diagrammatically the general layout of the complete electrical system, including the arrangement of feeders, circuits, panelboards, service equipment, and other work. Field verifications of scale dimensions taken from the drawings are directed since actual field locations, distances and elevations will be governed by actual field conditions. Review architectural, structural, mechanical and plumbing drawings and adjust work to conform to all conditions indicated thereon. Discrepancies shown on different plans or between plans and actual field conditions, or between plans and specifications, shall promptly be brought to the attention of the Architect for a decision.

1.10 COORDINATION AND COOPERATION
A. Drawings and specifications are both supplementary and complementary. Taken together, they are intended to define complete working installations of the systems represented, in accordance with approved practice in the trade, and in conformity with all applicable requirements of local jurisdictional offices and officers and codes and enforcing bodies.

B. It shall be presumed that any bid offered under this Division of the Specifications is based on a careful examination of the job site, and of the plans and specifications; that the person(s) or firm(s) awarded a contract hereunder is/are experienced and qualified in the type of work represented; that every effort has been made to prepare complete, accurate and correct plans and specifications; and that reasonable diligence will be exercised in planning and scheduling the work to anticipate conflicts and/or detect errors or omissions. All such shall be immediately reported, and proper resolution agreed on between concerned parties before the work affected is performed. If due to lack of diligence, or to incompetence, failure to anticipate such problems shall not create a valid claim for extra costs or charges.

C. Requirements of other trades, of utility companies, and of fire departments, protective services, communication systems, or other facilities of a utility nature, shall be determined prior to installation of systems, equipment, devices or materials affected by or dependent on such requirements.

D. Unapproved deviations or changes based on a presumption of error or code violation, or work not suitable for its intended function, may not be accepted.

E. Nothing herein shall act to prevent or discourage the contractor from suggesting or discussing possible changes in the work where such might be beneficial to the contractor or the owner, or might facilitate the work of this or other trades.

F. Any work resulting in a claim for a change in the contract price must be approved and fully documented.

1.11 VISIT TO SITE

A. Visit the project site, take requisite measurements, and verify exact location of buildings, utilities, and other facilities, and obtain such other information as is necessary for an intelligent bid. No allowance will subsequently be made by the Architect or Owner for any error or omission on the part of the bidder in this connection.

1.12 RECORD DRAWINGS

A. Record of Job Progress: Keep an accurate dimensional record of the "as-built" locations and of all work; all as required. This record shall be kept up-to-date on blueline prints as the job progresses and shall be available for inspection at all times. It shall be reviewed by inspector prior to each monthly application for payment.

B. Record of Installation: Refer to Supplementary General Conditions.

C. Include on "as-built" drawings:
1. Routing of all buried or concealed electrical feeders and conduits.

D. Upon completion of the work, a completed set of as-built reproducible vellums and electronic file (ACAD 2004) on Cd/DVD disk(s) shall be delivered to the Architect.

1.13 GUARANTEE

A. All work shall be guaranteed for a minimum period of one year from either the official date of completion or from the date of acceptance by the Owner, whichever is the later date. The guarantee period for certain items shall be longer, as indicated in the specification for those items.

B. Should any trouble develop during the guarantee time due to defective material, faulty workmanship, or non-compliance with plans, specifications, codes or directions of the Owner, Architect, Engineer or Inspector, the Contractor shall furnish all necessary labor and materials to correct the trouble without additional charges.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes the following:
   1. Electrical identification.
   2. Cutting and patching for electrical construction.

1.02 SUBMITTALS
A. Product Data: For utility company electricity-metering components.
B. Shop Drawings: Dimensioned plans and sections or elevation layouts and single-line diagram of electricity-metering component assemblies specific to this Project.

1.03 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Devices for Utility Company Electricity Metering: Comply with utility company published standards.
C. Comply with NFPA 70.

1.04 COORDINATION
A. Coordinate chases, slots, inserts, sleeves, and openings for electrical supports, raceways, and cable with general construction work.
B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment that requires positioning before closing in the building.
C. Coordinate electrical service connections to components furnished by utility companies.
   1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for service entrances and electricity-metering components.
D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.01 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs. Strength rating to suit structural loading.

D. Slotted Channel Fittings and Accessories: Recommended by the manufacturer for use with the type and size of channel with which used.
   1. Materials: Same as channels and angles, except metal items may be stainless steel.

E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.


2.02 ELECTRICAL IDENTIFICATION

A. Identification Device Colors: Use those prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.

C. Tape Markers for Conductors: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

E. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape compounded for permanent direct-burial service, and with the following features:
   1. Not less than 6 inches wide by 4 mils thick.
   2. Embedded continuous metallic strip or core.
   3. Printed legend that indicates type of underground line.

F. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.

G. Warning and Caution Signs: Preprinted; comply with 29 CFR 1910.145, Chapter XVII. Colors, legend, and size appropriate to each application.
   1. Interior Units: Aluminum, baked-enamel-finish, punched or drilled for mechanical fasteners.
   2. Exterior Units: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate with 0.0396-inch, galvanized-steel backing. 1/4-inch grommets in corners for mounting.

H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.03 CONCRETE BASES

A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."

B. Concrete: 3000-psi, 28-day compressive strength.

2.04 CONCRETE BOXES

A. Concrete Boxes: Pre-cast reinforced, size and type as shown; Christy, Brooks or approved equal. All underground boxes shall be provided with traffic grade, spring loaded, bolt-down, steel cover.

PART 3 - EXECUTION

3.01 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom.
B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, slotted channel system components.

B. Dry Locations: Steel materials.

C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb minimum design load for each support element.

3.03 SUPPORT INSTALLATION

A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.

C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps except use spring-steel fasteners for 1-1/2-inch and smaller single raceways above suspended ceilings and for fastening raceways to slotted channel and angle supports.

D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:

1. Wood: Wood screws or screw-type nails.

2. Gypsum Board: Toggle bolts. Seal around sleeves with joint compound, both sides of wall.

3. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.

4. New Concrete: Concrete inserts with machine screws and bolts.

5. Existing Concrete: Expansion bolts.
   a. Comply with AWS D1.1 for field welding.

7. Light Steel Framing: Sheet metal screws.


10. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.

3.04 IDENTIFICATION MATERIALS AND DEVICES

   A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

   B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

   C. Self-Adhesive Identification Products: Clean surfaces before applying.

   D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

   E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

   F. Install warning, caution, and instruction signs where required to comply with 29 CFR 1910.145, Chapter XVII, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Indoors install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

   G. Install, where applicable, engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

   H. Provide service description etched on cover of all underground pull boxes.
3.05 FIRESTOPPING

A. Apply firestopping to cable and raceway sleeves and other penetrations of fire-rated floor and wall assemblies to restore original undisturbed fire-resistance ratings of assemblies. Firestopping installation is specified in Division 7 Section "Through-Penetration Firestop Systems."

3.06 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

3.07 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

END OF SECTION
SECTION 16060

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes grounding of electrical systems and equipment. Requirements specified in this Section may be supplemented by requirements of other Sections.

1.02 SUBMITTALS
A. Product Data: For ground rods.
B. Field quality-control test reports.

1.03 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled under UL 467 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Boggs, Inc.
   2. Copperweld Corp.
   3. Dossert Corp.
   5. Galvan Industries, Inc.
   8. Heary Brothers Lightning Protection Co.
   9. ILSCO.
12. Lightning Master Corp.
13. Lyncole XIT Grounding.
15. Robbins Lightning, Inc.
17. Superior Grounding Systems, Inc.
18. Thomas & Betts, Electrical.

2.02 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare, Solid-Copper Conductors: ASTM B 3.

G. Assembly of Bare, Stranded-Copper Conductors: ASTM B 8.

H. Bare, Tinned-Copper Conductors: ASTM B 33.

I. Copper Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

J. Copper Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

K. Tinned-Copper Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulated spacer.

M. Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items. Exothermic-welded type, in kit form, selected per manufacturer's written instructions.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.
1. Size: 3/4 inches in diameter by 120 inches long.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.

2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the indicated height above the floor.

E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

F. Equipment Grounding Conductors: Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

1. Install insulated equipment grounding conductors in feeders.

2. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

3. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

4. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location and per Section 17640.

   a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding bus per Section 17640.
b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

5. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing an insulated equipment grounding conductor with supply branch-circuit conductors.

G. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.

H. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

I. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers or supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

J. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building’s main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

K. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

L. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

M. Connections: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.


5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

6. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

7. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

8. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

9. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

10. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

11. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.02 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is indicated and at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
3. Provide drawings locating each ground rod, ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results. Nominal maximum values are as follows:

a. Equipment Rated 500 kVA and Less: 10 ohms.

b. Equipment Rated 500 to 1000 kVA: 5 ohms.

END OF SECTION
SECTION 16071

SEISMIC CONTROLS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It applies to and complements optional seismic-restraint requirements in the various electrical component Sections of these Specifications.

1.02 DEFINITIONS

A. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.

B. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independently of other structural elements during an earthquake.

1.03 SUBMITTALS

A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic-restraint component used. Include documentation of evaluation and approval of components by agencies acceptable to authorities having jurisdiction.

B. Shop Drawings: For components, physical arrangements, and installation details not defined by Drawings. Indicate materials and show calculations, design analysis, details, and layouts, signed and sealed by a professional engineer.

C. Pre-approval and Evaluation Documentation: By an agency approved by authorities having jurisdiction, showing maximum ratings of restraints.

D. Qualification data.

E. Field quality-control test reports.

1.04 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in California Building Code, unless requirements in this Section are more stringent.

B. Testing Agency Qualifications: An independent testing and inspection agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the inspection indicated.
1.05 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structure, architectural features, and mechanical, fire-protection, electrical, and other building systems.

B. Coordinate concrete bases with building structural system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.
3. Erico, Inc.
4. GS Metals Corp.
5. Loos & Company, Inc.
6. Mason Industries, Inc,
7. Powerstrut.
8. Thomas & Betts Corp.

2.02 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.

2.03 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components shall be at least twice the maximum seismic forces for which they are required to be designed.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.

C. Concrete Inserts: Steel-channel type.
D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

E. Welding Lugs: Comply with MSS SP-69, Type 57.

F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.04 SEISMIC-BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 570, GR 33.


3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.

4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Hanger Rod Stiffeners: Slotted steel channels, installed vertically, with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

B. Install structural attachments as follows:

1. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.

2. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.

3. Attachments to Existing Concrete: Use expansion anchors.
4. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.

5. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.

6. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.

7. Attachments to Wood Structural Members: Install bolts through members.

8. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

C. Install electrical equipment anchorage as follows:

1. Anchor panelboards, motor controls, switchboards, control, and distribution units as follows:
   a. Anchor equipment rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.
   b. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
   c. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.
   d. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
   e. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

D. Install seismic bracing as follows:

1. Install bracing according to spacings and strengths indicated by approved analysis.

2. Expansion and Contraction: Install to allow for thermal movement of braced components.

3. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

E. Accommodation of Differential Seismic Motion: Make flexible connections in raceways, cables, wireway, cable trays, and busway where they cross expansion- and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.
3.02 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspection agency to inspect seismic-control installation for compliance with indicated requirements.

B. Testing Agency: Engage a qualified testing and inspection agency to inspect seismic-control installation for compliance with indicated requirements.

C. Reinspection: Correct deficiencies and verify by reinspection that work complies with requirements.

D. Provide written report of tests and inspections.

END OF SECTION
SECTION 16120

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.02 SUBMITTALS
A. Field quality-control test reports.

1.03 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 CONDUCTORS AND CABLES
A. Manufacturers:
   1. Alcan Aluminum Corporation; Alcan Cable Div.
   3. General Cable Corporation.
   4. Senator Wire & Cable Company.
   5. Southwire Company.
B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
D. Conductor Insulation Types: Type THW, THHN-THWN or XHHW complying with NEMA WC 5 or 7.

2.03 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.


I. Fire Alarm Circuits: Type THHN-THWN, in raceway.

J. Class 1 Control Circuits: Type THHN-THWN, in raceway.

K. Class 2 Control Circuits: Type THHN-THWN, in raceway.
3.02 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."

F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."

G. Identify and color-code conductors and cables according to Division 16 Section "Basic Electrical Materials and Methods."

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

J. In raceways containing multiple circuits provide separate neutral for each circuit in accordance with NEC 210.4.

3.03 FIELD QUALITY CONTROL

A. Testing: Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION
SECTION 16130

RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 SUMMARY
   A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.02 SUBMITTALS
   A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets indicated.

1.03 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
      1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 METAL CONDUIT AND TUBING
   A. Manufacturers:
      1. AFC Cable Systems, Inc.
      2. Alflex Inc.
      3. Anamet Electrical, Inc.; Anaconda Metal Hose.
      4. Electri-Flex Co.
      5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
      6. LTV Steel Tubular Products Company.
      7. Manhattan/CDT/Cole-Flex.
      8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. EMT and Fittings: ANSI C80.3.
   1. Fittings: Compression type.

F. FMC: Aluminum.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings: NEMA FB 1; compatible with conduit and tubing materials. Stainless steel. Die-cast fittings are not acceptable.

I. Flexible Steel Metal Conduit:
   1. T & B 5331 to 5338 series, insulated; or equal with watertight fittings and insulated bushings.
   2. Interior fittings shall be T & B Tite Bite series, steel fittings.

2.03 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:
   2. Anamet Electrical, Inc.; Anaconda Metal Hose.
   3. Arnco Corp.
   4. Cantex Inc.
   7. ElecSYS, Inc.
   8. Electri-Flex Co.
   9. Lamson & Sessions; Carlon Electrical Products.
   10. Manhattan/CDT/Cole-Flex.
   11. RACO; Division of Hubbell, Inc.
12. Spiralduct, Inc./AFC Cable Systems, Inc.


B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

2. Emerson/General Signal; Appleton Electric Company.

3. Erickson Electrical Equipment Co.


6. O-Z/Gedney; Unit of General Signal.

7. RACO; Division of Hubbell, Inc.


B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

I. Concrete Boxes: Pre-cast reinforced, size and type as shown; Christy, Brooks or approved equal. All underground boxes shall be provided with traffic grade, spring loaded, bolt-down, steel cover.
2.05 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components provide manufacturer's standard prime-coat finish ready for field painting.

2.06 FIRESTOPPING FOR LOW VOLTAGE SLEEVES

A. Firestop Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:
   1. Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows

B. Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
   1. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway
   2. Specified Technologies Inc. (STI) Mini EZ-PATH™ Fire Rated Pathway

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors:
   1. Exposed: Rigid steel or IMC.
   2. Concealed: Rigid steel or IMC.
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoors:
   1. Exposed: EMT.
   2. Concealed: EMT.
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
   4. Damp or Wet Locations: Rigid steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
   a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
   3. For Outdoor Use – conduit hub, NEMA 4 for conduit connection/terminating to cabinet/panel/boxes.
   4. All connectors to be steel. Die cast connectors are not acceptable.
   E. Do not install aluminum conduits embedded in or in contact with concrete.

3.02 INSTALLATION

A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
   1. Install concealed raceways with a minimum of bends in shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

H. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.
   1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

4. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

   1. Run parallel or banked raceways together on common supports.
   2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.

   1. Use insulating bushings to protect conductors on all raceways 2” and larger.

K. Tighten set screws of threadless fittings with suitable tools.

L. Terminations:

   1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
   2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

N. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.
P. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

Q. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

S. Set floor boxes level and flush with finished floor surface.

T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.03 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION
SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Single and duplex receptacles, ground-fault circuit interrupters.
   3. Device wall plates.
   4. Floor service outlets, poke-through assemblies and multioutlet assemblies.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
C. Samples: One for each type of device and wall plate specified, in each color specified.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Wiring Devices:
      b. Eagle Electric Manufacturing Co., Inc.
      c. Hubbell Incorporated; Wiring Device-Kellems.
d. Leviton Mfg. Company Inc.
e. Pass & Seymour/Legrand; Wiring Devices Div.

2. Multioutlet Assemblies:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Wiremold Company (The).

3. Poke-Through, Floor Service Outlets and Telephone/Power Poles:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Pass & Seymour/Legrand; Wiring Devices Div.
   c. Square D/Groupe Schneider NA.
   d. Thomas & Betts Corporation.
   e. Wiremold Company (The).

2.02 RECEPTACLES

A. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

B. Straight-Blade Receptacles: Hospital grade.

C. GFCI Receptacles: Straight blade, non-feed-through type, Hospital or Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.

D. Receptacles dedicated as DATA and ISIS in panelboard schedules: P&S 6300/S-8-1G or equal.


F. Snap Switches: Heavy-Duty grade, quiet type.

2.03 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces:
      a. Stainless steel.
      b. 0.035-inch thick, satin-finished stainless steel (above counters and in restrooms)
4. Material for Wet Locations: Cast aluminum with spring-loaded, lockable, lift cover, and listed and labeled for use in "wet locations."

2.04 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Install wall dimmers to achieve indicated rating after derating for ganging.

C. Install unshared neutral conductors on line and load side of dimmers.

D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

E. Remove wall plates and protect devices and assemblies during painting.

F. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

3.02 IDENTIFICATION

A. Comply with Division 16 Section "Basic Electrical Materials and Methods."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

2. Submit same for approval.

3.03 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION
SECTION 16410

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Molded-case circuit breakers.

1.02 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.

2. General Electric Co.; Electrical Distribution & Control Division.


4. Square D/Group Schneider.
B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open (required for all disconnects located downstream of Variable frequency Drives)

2.03 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.

2. General Electric Co.; Electrical Distribution & Control Division.


4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.


3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.

4. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Concrete base is specified in Division 16 Section "Basic Electrical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.

B. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
3.02 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:
   1. Inspect mechanical and electrical connections.

B. Perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

   END OF SECTION
SECTION 16441

DRY-TYPE TRANSFORMERS (600 V AND LESS)

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

   1. Distribution transformers.
   2. Control and signal transformers.

1.02 SUBMITTALS

A. Product Data: For each product indicated.
B. Shop Drawings: Wiring and connection diagrams.
C. Output Settings Reports: Record of tap adjustments specified in Part 3.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with IEEE C 57.12.91.
C. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2. Transformers shall be EPA Energy Star® compliant and bear the Energy Star® label.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Electric Corporation; Power Distribution Products Division.
3. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.
4. GE Electrical Distribution & Control.
5. Siemens Energy & Automation, Inc.
6. Square D/Groupe Schneider NA.

2.02 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
B. Cores: Grain-oriented, non-aging silicon steel.
C. Coils: Continuous windings without splices, except for taps.
   1. Internal Coil Connections: Brazed or pressure type.

2.03 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
B. Provide transformers that are internally braced to withstand seismic forces specified in Division 16 Section "Seismic Controls for Electrical Work."
C. Cores: One leg per phase.
D. Enclosure:
   1. Ventilated, NEMA 250, Type 2 (indoor)
   2. Ventilated, raintight, NEMA 250, Type 3R (for exterior at secured areas)
   3. Totally enclosed, nonventilated, with lifting eyes, NEMA 250, type suitable for outdoor use (for exterior at public accessible locations)
   4. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
E. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
F. Taps for Transformers Smaller Than 3 kVA: None.

G. Taps for Transformers 7.5 to 24 kVA: Two 5 percent taps below rated voltage.

H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

I. Wall Brackets: Manufacturer's standard brackets.

J. Sound levels shall be warranted by the manufacturer not to exceed the following: 1515 to 50kVA - 45dB; 51 to 150kVA - 50dB; 151 to 300kVA - 55dB; 301 to 500kVA - 60dB; 501 to 700kVA - 62dB; 701 to 1000kVA - 64dB.

K. Transformers shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accordance with NEMA TP2.

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2.04 CONTROL AND SIGNAL TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.

B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

2.05 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.
PART 3 - EXECUTION

3.01 INSTALLATION
   A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
   B. Install floor-mounting transformers level on concrete bases.

3.02 CONNECTIONS
   A. Ground equipment according to Division 26 Section "Grounding and Bonding."
   B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 ADJUSTING
   A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.
   B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION
SECTION 16521

EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes lighting fixtures, complete with lamps, poles and bases, as shown; and related work.

B. Provide and install concrete pole bases as detailed on drawings.

1.02 MANUFACTURER

A. Light fixtures shall be as shown or scheduled, installed complete and ready for service, including new lamps throughout. Finishes shall be as selected from standard type available and in colors approved by Architect. All fixtures to be U.L. approved and thermal protected where required per code.

PART 2 - MATERIALS

2.01 EXTERIOR LUMINAIRES, GENERAL

A. Comply with UL 1598 and listed for installation in wet locations.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

I. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

2.02 LAMPS

A. Compact Fluorescent as specified.

B. Turn over job with all lamps in new and operating condition.

2.03 CONTROLS

A. Exterior lighting shall be controlled by photocell with astronomical timeclock.

PART 3 - EXECUTION

3.01 GENERAL

A. In areas with exposed duct or pipe or other interferences, suspend fixtures to heights shown or directed as necessary to avoid conflict with such obstructions.

B. Set and securely fasten each unit to pole base; adjust locations and levels as necessary to leave units plumb, level and in straight and level alignments.

C. Any ballasts exhibiting audible noise when installed shall be replaced as directed by Architect, at no added expense to Owner.

3.02 PAINTING

A. Exposed conduit, hangers, etc. will be painted under PAINTING Division. Equipment and lighting fixtures shall be provided with manufacturer's standard finish as selected by the Architect. Finishes damaged during installation shall be repaired to match factory-applied finish.

END OF SECTION