



# **General Construction Specifications**

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## SECTION 02 41 16

### STRUCTURE DEMOLITION

#### PART 1 – GENERAL

##### 1.1 SUMMARY

- A. Work included: All labor, materials, and equipment required for removal of existing materials as indicated and disposition of debris legally to an off-site location.

##### 1.2 SUBMITTALS

- A. Schedule: Include in a detailed schedule showing start and completion dates for demolition and for completion of demolition work. Submit method of demolition and plan of removing work after receiving notice to proceed.
- B. Certification: Submit copy of demolition firm's current license to operate California.

##### 1.3 QUALITY ASSURANCE

- A. Organize and perform demolition work to avoid damage to existing construction intended to remain.
- B. Demolition and transportation of debris shall comply with Federal, State and Local applicable codes and regulation governing these operations.
- C. Demolition and removal operations shall be conducted in an expedient manner, with precautions taken to prevent demolition site from being an "attractive nuisance".
- D. Notify the District and Architect of any conditions capable of affecting the safety of occupants of adjacent buildings, the normal use of these facilities, or the physical condition of the structures.
  - 1. In case of accidental disruption of utilities or the discovery of previously unknown utilities, stop work immediately and notify the District and Architect.
  - 2. Do not continue work until the District, Architect and Contractor agree on a plan to correct the situation or identify utility service line.

##### 1.4 SEQUENCING AND SCHEDULING

- A. Scheduling: Areas next to demolition and removal work may be occupied and their activities cannot be interrupted or disturbed during normal working hours. Demolition schedule shall be accepted by the District.
- B. Coordinate with applicable utility companies and the District for utility locating survey, capping and utility shutdowns required by removal work.

##### 1.5 PROJECT CONDITIONS

- A. Existing work not specified for removal that is temporarily removed, damaged, exposed or in any way disturbed or altered by removal work shall be repaired, patched, or replaced to the District and Architect's satisfaction at no additional cost to the District.
- B. Provide barriers and warning devices to protect the public and users of adjacent facilities.
- C. Environmental Protection:
  - 1. Control amount of dust resulting from construction or demolition to prevent spread of dust to other buildings and to avoid creation of a nuisance in surrounding areas. Use of water to control dust will not be allowed when it will result in flooding or other objectionable or hazardous conditions.
  - 2. Use of explosives is not allowed.
  - 3. Disposition of demolished materials by burning is not allowed.
- D. Traffic Maintenance:
  - 1. Conduct removal operations to maintain traffic along existing streets and walks.
  - 2. Keep paved streets and walkways free of debris.
  - 3. Remove material and other matter tracked or fallen onto traffic surfaces.
  - 4. If it should become necessary to close any traffic lanes, it shall be the Contractor's responsibility to acquire the necessary obstruction permits and to place adequate barricades and warning signs as required by the jurisdiction.
  - 5. Street or lane closures shall be coordinated with the appropriate Jurisdiction.
- E. Disposition of Materials:
  - 1. Title and responsibility to materials and equipment to be removed, excepting salvageable equipment to be retained by the District, is vested in the Contractor upon receipt of Notice to Proceed.
  - 2. The District will not be responsible for the condition, the loss, or damage to such materials and equipment after the Notice to Proceed.
- F. Site utilities:
  - 1. Provide minimum of 72 hours notice before any disruption of utility services to the occupied areas.
  - 2. All existing parking lighting circuits shall be rerouted to the new structures.
- G. Permits and Fees:

The Contractor shall obtain all the necessary permits and pay all permit fees that are required by the Jurisdiction in conjunction with the demolition work.

## **PART 2 – PRODUCTS**

**(NOT APPLICABLE)**

## **PART 3 – EXECUTION**

### 3.1 DEMOLITION

- A. Walkways and parking pavement:
  - 1. Demolish existing indicated walkways and parking pavement according to accepted schedule.
- B. Perform removal and demolition according to Demolition Schedule and take necessary precautions to protect existing adjacent buildings, furnishings, and equipment.
- C. Existing Utilities: Perform utility related work according to these specifications for the type of utility service involved.
- D. Removal:
  - 1. Remove demolished construction materials and related debris from the site on a daily regular basis.
  - 2. Accumulation of debris on the site will not be allowed.
  - 3. Selling of salvageable building materials or equipment or furnishings is not allowed at the site.

### 3.2 SALVAGE OF DEMOLITION MATERIALS

- A. The Contractor shall be allowed to salvage demolition material only from the removed demolished materials from the project sites. Salvaged items shall be removed from the site on daily basis.
- B. The Contractor may recycle demolition debris at a licensed or permitted recycling center; however, all other debris must be disposed of at a licensed or permitted disposal facility.
- C. The Contractor may salvage demolition materials on District property as long as demolition is completed within the provisions included in the Contract Documents. All building materials and building furnishings resulting from this work shall become the property of the Contractor, and shall be removed from the premises at once. Salvaged material shall be removed immediately from the premises, right-of-way, streets or alleys.

### 3.3 EXISTING ITEMS TO BE SALVAGED

- A. Reuse of Items and Materials: Carefully remove and store materials and equipment indicated to be reused to prevent damage, and reinstall as the work progresses.
- B. District does not intend to salvage any item and materials except light poles as directed by the District.
- C. REPLACEMENT OR REPAIR: In the event of demolition of items not scheduled for demolition, promptly replace or repair items at no additional cost to the Owner.

### 3.4 HAZARDOUS MATERIAL

- A. Hazardous materials, if encountered, must be handled according to State and Federal laws.

- B. The handling of asbestos and lead material is subject to all applicable local, state and federal mandates. In the event that asbestos is discovered during demolition, the Contractor shall notify the District and the asbestos shall be removed by a licensed abatement contractor by contract or in accordance with the applicable provisions.

### 3.5 CLEAN UP

- A. Daily Cleaning: Remove rubbish and debris from the site daily.
- B. Debris and Rubbish: Transport and dispose of debris and rubbish in a manner that will comply with applicable regulations. Clean sidewalks, streets and private property of any debris caused by the demolition work.
- C. Cleanup will include sweeping and other cleaning methods for complete removal of all building debris and dust from the air and at all exposed surfaces.
- D. Level and compact the sub grade after removing the demolished material. Sub grade must be free of building debris.

END OF SECTION

**SECTION 03 11 00**  
**CONCRETE FORMING**

**PART 1 - GENERAL**

1.1 DESCRIPTION:

- A. Work Included: Furnish, install and remove forms for cast-in-place concrete including shoring and form supports.
- B. Related Work Specified Elsewhere:
  - 1. Under-Slab Vapor Barrier - 03 30 01
  - 2. Cast-In-Place Concrete – 03 30 00.
  - 3. Concrete Reinforcing – 03 20 00.
  - 4. Concrete Finishing 03 35 00.

1.2 REFERENCES, CODES AND STANDARDS: The following references, codes and standards are hereby made a part of this Section and formwork shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.

- A. "Recommended Practice for Concrete Formwork", ACI 301,318 & 347 latest editions.
- B. California Building Code.

1.3 ALLOWABLE TOLERANCES: Design, construct, set and maintain the formwork so as to insure complete work within the suggested tolerance limits specified in ACI 347-78, Section 3.3.1. See Concrete Finishing Section 03 35 00 for slab tolerances.

**PART 2 - PRODUCTS**

2.1 MATERIALS:

- A. Earth Forms: Unless otherwise indicated or required by the Structural Drawings, concrete for footings may be placed directly against vertical excavated surfaces provided the material will stand without caving and provided that minimum reinforcing steel clearances indicated on Drawings are maintained and suitable provisions are taken to prevent raveling of top edges or sloughing of loose material from walls of excavation. Sides of excavation shall be made with a neat cut and the width made as detailed on Drawings. Concrete which is exposed to view on exterior shall be formed to a minimum depth of 1'-0" below finished grade.
- B. Wood Forms:
  - 1. Exposed Concrete Not Otherwise Noted or Specified: APA Plyform, Grade B-B, Class I or II (as per strength and tolerance requirements), Exterior Grade.
  - 2. Unexposed Concrete Not Otherwise Specified: Of sufficient design and strength to hold concrete properly in place and alignment.
  - 3. Framing: At Contractor option subject to meeting necessary strengths and surface tolerances.
- C. Form Release Agents:



1. Exposed Concrete Including Surfaces to Receive Paint and Other Coatings: Chemically active type producing water insoluble soaps. Form release agents shall be delivered in manufacturer's sealed and trademarked containers and shall be guaranteed to provide clean, stain-free concrete release and not to interfere with future applied coatings and finishes. Release agents shall contain no petroleum solvents such as creosote, paraffin, waxes or diesel oil.
  2. Unexposed Concrete: Contractor option except that release agents shall not interfere with bond of any applied finish.
- D. Form Ties: Contractor option except that wire ties and wood spreaders are not allowed for exposed concrete. Wood spreaders shall not remain in concrete.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION:**

- A. Vertical and Horizontal Controls: Establish and maintain necessary benchmarks, lines, or controls throughout construction.
- B. Secure information and provide for openings, sleeves, chases, foundation vents, pipes, recesses, nailers, anchors, ties, inserts, and similar embedded items. Coordinate with concrete work for requirements governing embedment and sleeving of pipes and conduit.

#### **3.2 ERECTION:**

- A. Formwork - General: Construct wood forms of sound lumber, straight and rigid, thoroughly braced, mortar tight, and of such strength that the pressure of concrete and the movement of men and equipment will not displace them. Visible waves in exposed concrete surfaces after stripping of forms may result in rejection of that portion of the concrete. The design and engineering of formwork shall be the complete responsibility of the Contractor.
- B. Plywood Forms for Exposed Concrete: Plywood panels shall be clean, smooth, uniform in size, and free from damaged edges or faces (including holes other than those required for form ties). Make joints plumb. Block plywood edges which do not occur at bearing points in order to eliminate joint offsets.
- C. Framing and Bracing: Framing, bracing and supporting members shall be of ample size and strength to safely carry, without excessive deflection (exceeding allowable tolerances), all dead and live loads to which formwork may be subjected, and shall be spaced sufficiently close to prevent any apparent bulging or sagging of forms.
- D. Form Ties: Form ties shall be of sufficient strength and used in sufficient quantities to prevent spreading of the forms. Ties for exposed concrete surfaces shall be arranged symmetrically.
- E. Arrange forms to allow proper erection sequence and to permit form removal without damage to concrete.
- F. Form Release Agent: Thoroughly clean forms and coat with release agent prior to initial use and before each reuse. Apply release agent in strict accordance with manufacturer's directions and coverage recommendations avoiding starved areas or excessive applications. Apply release agents before reinforcing steel is placed.
- G. Prior to placement of concrete, remove dirt, debris and foreign material from forms. Leave no wood in concrete except nailers or dividers.

- H. Provide chamfer strips at all concrete edges; use  $\frac{3}{4}$ " x  $\frac{3}{4}$ " except as noted on drawings.

### 3.3 INSERTS, EMBEDDED PARTS AND OPENINGS:

- A. Provide formed openings where required for work embedded in or passing through concrete.
- B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

### 3.4 FALSEWORK:

- A. Contractor shall be fully responsible for proper strength, safety and adequacy of falsework, supports and bearing surfaces therefor used on and in connection with the work. Falsework shall be designed to support imposed loads without deformation, deflection or settlement.

### 3.5 REMOVAL OF FORMS AND FALSEWORK:

- A. The removal of forms and falsework shall be carried out in such manner as to ensure the complete safety of the structure. Supports shall not be removed until members have sufficient strength to safely support their own weight and any superimposed loading with proper factor of safety.
- B. After concrete is placed, the following minimum times shall elapse before the removal of forms:
  - 1. Side Forms (Foundations): 24 hours.
- C. Upon removal of forms, bolts, wires, clamps, rods, etc., not necessary to the work, shall be removed to a minimum of 1 inch from the surface. The Contractor shall so conduct his operations as to eliminate any danger of rust stains from form tie materials or other unprotected ferrous materials embedded in or adjacent to exposed concrete surfaces.

END OF SECTION

## SECTION 03 20 00

### CONCRETE REINFORCING

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION:

- A. Work Included: Furnish and install all reinforcement for cast-in-place concrete work.
- B. Related work specified elsewhere:
  - 1. Concrete Forming – 03 11 00.
  - 2. Cast-In-Place Concrete – 03 30 00.
  - 3. Metal Fabrications – 05 50 00.
  - 4. Rough Carpentry – 06 10 00.
  - 5. Concrete Paving – 32 13 13.

##### 1.2 REFERENCES, CODES AND STANDARDS: The following references, codes and standards are hereby made a part of this Section and all reinforcement shall conform to the applicable requirements therein except as otherwise specified herein or shown on the drawings. Nothing contained herein shall be construed as Permitting work that is contrary to code requirements.

- A. ACI 301 – Specifications for Structural Concrete for Buildings.
- B. ACI 315 – Details and Detailing of Concrete Reinforcement.
- C. ANSI/AWS D1.4 – Structural Welding Code, Reinforcing Steel.
- D. RSI – Manual of Practice.
- E. CRSI 65 – Recommended Practice for Placing Reinforcing.
- F. ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- G. ASTM A706 – Standard Specification for Low-alloy Steel Deformed Bars for Concrete Reinforcement.
- H. California Building code (CBC).

##### 1.3 SOURCE QUALITY CONTROL: Where certified mill test reports (required hereinafter under "Submittals") are not furnished, conform to the following:

- A. Reinforcing bars shall be tested in tension and bending as per ASTM A 615. Testing shall be done by the Contractor's independent testing agency. Furnish one copy of test reports to Architect, Structural Engineer, Owner, and Inspector.
- B. Samples will be taken from bundles as delivered from the mill by the testing agency. Where bundles are identified by a heat number and a mill analysis accompanies to report, one tensile and one bending test specimen will be taken from each 10 tons or fraction thereof, of each size and kind of bar. Where positive identification of heat numbers cannot be made or where random samples are taken, one series of tests shall be made from each 2-1/2 tons or fraction thereof, of each size and kind of bar.

- C. The cost of all tests, sampling and handling of reinforcing steel shall be paid by the Contractor.
- D. Include all material required to provide samples for testing.
- E. The following is subject to Special Inspection as per DSA. All costs therefore will be paid by the Owner.
  - 1. Placement and welding of reinforcing steel in masonry walls requiring special inspection.

1.4 SUBMITTALS:

A. Shop Drawings:

- 1. Fully detailed shop drawings, including bending schedules and bending diagrams, shall be submitted to the Inspector for review. Shop drawings shall show placing details and size and location of all reinforcing steel.
- 2. Shop drawing shall be of such detail and completeness that all fabrication and placement at the site can be accomplished without the use of project or contract drawings for reference.
- 3. Contractor shall check civil, landscape, architectural, structural, mechanical, plumbing, electrical and fire protection project or contract drawings for anchor bolt schedules and locations, anchors, inserts, conduits, sleeves, and any other items which are required to be cast in concrete, and shall make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.

- B. Mill Test Reports: Certified mill test reports (tensile and bending) for each heat or melt of steel shall be submitted to the Architect before delivery of any material to the site. (See requirements above under "Source Quality Control".) Where reinforcing is required to be welded, mill test reports shall verify the weldability of the steel.

- 1.5 DELIVERY AND STORAGE: Deliver reinforcing to site properly bundled and tagged, and stored so as to prevent excessive rusting or fouling with grease or any coating that will interfere with bond. Segregate so as to maintain identification after bundles are broken. Do not use damaged, reworked, or deteriorated material.

**PART 2 - PRODUCTS**

2.1 MATERIALS:

A. Reinforcing Bars:

- 1. New, free of loose rust.
- 2. Billet Steel Bars: ASTM A 615, including supplementary requirements S1. Grade 60 for all bars weldable where indicated or required.

- B. Welded Wire Fabric: ASTM A 185, 6x6 – W1.4 x W1.4 WWF

- C. Tie Wire: #16 minimum, black and annealed.

- D. Accessories: Metal or plastic spacers, supports, ties, etc., as required for spacing, assembling, and supporting reinforcing in place. Legs of accessories to be of type that will rest on forms without embedding into forms. Galvanize metal items where exposed to moisture, or use approved other non-corrodible, non-staining supports.

## 2.2 FABRICATION:

- A. Comply with details on Drawings.
- B. Where specific details are not shown or noted, do all detailing and fabrication in conformance with, or superior to, requirements contained in the References, Codes and Standards Article and ACI 315.
- C. Clean bars of loose rust, loose mill scale and any substance which may decrease bond. Bend bars cold and accurately to details on reviewed shop drawings.
- D. Shop fabricate all reinforcement.

## PART 3 - EXECUTION

### 3.1 PLACING:

- A. General: Reinforcing steel shall be placed in accord with the Drawings and viewed shop drawings and the applicable requirements of the References, Codes and Standards Article. Install reinforcement accurately and secure against movement, particularly under the weight of workmen and the placement of concrete.
- B. Reinforcement Supports:
  - 1. Reinforcement shall be accurately located in the forms and held in place by means of supports adequate to prevent displacement and to maintain reinforcement at proper distance from form face. Supports and their placement shall comply with CRSI "Placing Reinforcing Bars". The use of wood supports and spacers inside the forms is not permitted except as noted in Concrete Forms Section.
  - 2. Support reinforcement for on-grade slabs by wiring to precast concrete blocks spaced 3'-0" o.c. (maximum) both ways, staggered. Size blocks so that reinforcing is maintained at the center line of the slab.
- C. Obstructions: Wherever conduit, piping, inserts, sleeves, etc., interfere with placing of reinforcing steel, obtain approval of method of procedure before any concrete is placed. Bending of bars around openings or sleeves is not permitted.
- D. Tying: All reinforcing shall be rigidly and securely tied with steel tie wire at all splices and at all crossing points and intersections in the position shown. All tie wires, after cutting, shall be bent in such a manner that concrete placement will not force the wire ends to surface of exposed concrete.
- E. Welded Wire Fabric: Fabric shall be in as long lengths as practicable and shall be wired at all laps. Edge laps shall be a minimum of 2" c-c of selvage wires and end laps shall be a minimum of 2" greater than transverse wire spacing. Offset all end laps in adjacent widths.
- F. Dowels: Dowels shall be tied securely in place before concrete is deposited. In the event there are no bars in position to which dowels may be tied, No. 3 bars (minimum) shall be

added to provide proper support and anchorage. Bending of dowels after placement of concrete will not be permitted.

- G. A minimum class C lap splice as defined by ACI 318 is required for all cases not otherwise shown on Drawings. Stagger splices wherever possible.
- H. Welding: Do all welding by Cadweld T series for bars #10 and larger or as noted on Drawings. No welding of reinforcing steel or of attachments to reinforcing steel will be permitted unless the chemistry of the steel conforms to AWS D12.1 and is so established by the mill certificates. If welding is to be done, all welds shall be approved by the Structural Engineer and all welding shall comply with requirements and procedures established by AWS D12.1. All welding material, wire cuttings, and tramp metal shall be thoroughly cleaned from forms for exposed concrete before any concrete is placed.
- I. Minimum covers for reinforcement:

Wall Surface	1-1/2"
Formed Surface in Contact with Earth	2"
Unformed Surface in Contact with Earth	3"
- J. Lap or spliced bars shall be a minimum of 48 bar diameters in concrete, but never less than 24".

3.2 CLEANING: Reinforcement, at time of placing concrete, shall be free of any coating that would impair bond.

END OF SECTION

## SECTION 03 30 00

### CAST-IN-PLACE CONCRETE\*

#### PART 1 – GENERAL

**\*In cases of conflict with DSA approved design, the DSA approved design shall be used.**

##### 1.1 DESCRIPTION:

A. Work Included: Furnish and install cast-in-place concrete required for the project as shown on the Drawings and specified herein. This Section also includes:

1. Concrete for work specified in Mechanical and Electrical Divisions unless specifically included therein.
2. Grouting of bases and equipment not specified under other Sections.
3. Coordination with other trades with regard to requirements for special bases, sleeves, chases, inserts, finishes or provisions, of any nature.
4. Curing of formed concrete surfaces.
5. Installation of anchor bolts, hangers, anchors, plates, inserts and miscellaneous metal or other materials embedded in concrete and which are furnished by other trades.

B. Related Work Specified Elsewhere:

1. Aggregate base for slabs on grade.
2. Earthwork – 31 00 00.
3. Concrete Forming – 03 11 00.
4. Concrete Reinforcing – 03 20 00.
5. Duct encasement for underground electrical service lines (if required: Site Concrete – 02765): See Electrical.

1.2 REFERENCES, CODES AND STANDARDS: The following references, codes and standards are hereby made a part of this Section and concrete work shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.

A. "Building Code Requirements for Reinforced Concrete", ACI 318, latest edition.

B. California Building Code.

##### 1.3 FIELD QUALITY CONTROL:

A. Tests and inspections shall be performed by qualified individuals, engineering companies or testing laboratories who shall perform those special inspections required by DSA, those tests and inspections specified below and such other tests and inspections as the Architect or Owner may require to establish the acceptability of the work.

B. Testing and inspection services shall be retained by the Owner at his expense except that when tests or inspections reveal failure of materials to meet the contract requirements, costs for subsequent tests and inspections will be deducted from monies due the Contractor. Excessive inspection time required by Contractor's failure to provide sufficient workmen or to properly pursue the progress of the work shall likewise be deducted.

- C. Furnish material and handling for test cylinders and any other samples which testing agency requires for analysis of concrete work.
- D. Compression Tests: 3 compression test cylinders as per ASTM C 31. One cylinder will be broken at 7 days; one at 28 days; and one cylinder retained as a spare. Cylinders will be numbered in sets (1A, 1B, 1C; 2A, 2B, 2C; etc.) and a record kept of extent of pour represented by each set and type of concrete tested. Cylinders will be broken in accordance with ASTM C 39. If any test report indicates 28-day specimen below required strength (within standard of acceptability established by ACI 318), and if required by Architect, testing agency will take test cores of hardened concrete in accordance with ASTM C 42. Such concrete shown to be defective shall be removed and replaced. Cost of core tests, repairs and removal and replacement of defective concrete shall be paid by Contractor.
- E. One (1) additional test cylinder: taken during cold weather concreting and cured on job site under same conditions as concrete it represents.
- F. One (1) slump test: taken for each set of test cylinders taken.
- G. Samples will be taken from bundles as delivered from the mill by the testing agency. Where bundles are identified by a heat number and a mill analysis accompanies to report, one tensile and one bending test specimen will be taken from each 10 tons or fraction thereof, of each size and kind of bar. Where positive identification of heat numbers cannot be made or where random samples are taken, one series of tests shall be made from each 2-1/2 tons or fraction thereof, of each size and kind of bar.
- H. The cost of all tests, sampling and handling of reinforcing steel shall be paid by the Contractor.
- I. The following is subject to Special Inspection as per DSA. Costs therefore will be paid by the Owner.
  - 1. Taking of compression test specimens.
  - 2. Placement of reinforced structural concrete.

1.4 ENVIRONMENTAL CONDITIONS:

- A. Cold Weather Requirements: Comply with "Recommended Practice for Cold Weather Concreting", ACI 306R, latest edition.
- B. Hot Weather Requirements: Comply with "Recommended Practice for Hot Weather Concreting", ACI 305R, latest edition.

**PART 2 - PRODUCTS**

2.1 MATERIALS

- A. Cement: ASTM C 150, Type I or II, Portland Type. Cement shall be of same brand, type and source throughout project. Where aggregates are potentially reactive, use low alkali cement.
- B. Aggregates: ASTM C 33 and C 88 from sources with proven history of successful use. Source shall be constant unless 10 days' prior notice is given for approval after recheck of mix design.
  - 1. Fine Aggregate: Natural sand with sand equivalent of not less than 75 when tested as per Test Method Calif. 217-E.



2. Coarse Aggregate: Fine grade, sound crushed stone, natural gravel or granite with cleanness value not less than 75 when tested as per Test Method Calif. 227.
- C. Water: Clean and potable, free from impurities detrimental to concrete.
- D. Admixtures:
  1. Air Entrainment Admixtures: ASTM C R60.
- E. Expansion Joint Fillers (On-Grade Slabs, Walks, Curbs, Gutters and Similar Flatwork Where Joints Are Not Otherwise Noted or Specified): ASTM D 994-71, asphaltic compound strips, 1/4" thick unless otherwise noted, precut to proper size.
- F. Non-Shrink Grout (Metallic): Master Builders "Embeco 636", Sonneborn-Contech "Ferrolith G", or approved equal, premixed metallic grout.
- G. Non-Shrink Grout (Non-Metallic): Sauereisen No. F-100, Sonneborn Contech "Fondag", Upco "Upcon", 5-Star, Master Builders "Masterflow 713", or approved equal, nonmetallic, nonstaining, premixed grout having a compressive strength at 28 days of not less than 6800 psi.
- H. Curing Compounds (Formed Concrete): Conform to requirements of Concrete Finishes Section.
- I. Bonding Agent: Polymer Resin Emulsion.

## 2.2 MIXES:

- A. Mix and deliver concrete in accordance with ASTM C94 Alternative 4.
- B. Provide concrete in the following strength:
  1. 3000 psi (28 day).
- C. Select admixture proportions for normal weight concrete in accordance with ACI 318.
- D. Add air entraining agent to concrete mix for work exposed to exterior.
- E. Walks, curbs and paving etc., shall be per project standards.
- F. Mix designs for concrete shall be Contractor-designed at his expense. Designs shall be prepared by a qualified agency approved by the Architect. Four (4) copies of mix designs shall be submitted for Architect's review prior to placing any concrete and shall indicate completely, brands, types and quantities of admixtures included. If concrete is to be placed by pumping, recommendations of ACI Committee 304 shall be followed and mix designs must include strengths and slumps.

## PART 3 - EXECUTION

- 3.1 MIXING: Concrete shall be ready mixed as per ASTM C 94. Equipment shall be adequate for the purpose and kept in good mechanical condition at all times.
- 3.2 PLACING:
  - A. Absorbent forms shall be thoroughly wetted before concrete is placed. Aggregate base for slabs on grade shall be moist but not saturated when concrete is laced.

- B. Placing of concrete shall be done immediately after mixing. No concrete shall be placed or used after it has begun to set and no retempering will be allowed. The method used in placing shall be such that concrete is conveyed to place and deposited without separation of the ingredients. No concrete shall be placed with a free unconfined fall in excess of five (5) feet nor shall it be allowed to cascade through reinforcing steel in such manner as to promote segregation. Do not support runways on reinforcing steel.
- C. Splash or accumulations of hardened or partially hardened concrete shall be removed. Contact faces of forms for exposed concrete shall be protected from splash during placing of adjacent concrete. Concrete containing piping shall be placed in a manner that will prevent damage to pipes.
- D. Deposit concrete in approximate horizontal layers not exceeding 18" in thickness, unless otherwise authorized. Placing of concrete shall be carried on in a continuous operation without interruption until placing of course, section, panel or monolith is completed.
- E. Distribution of concrete shall be even and continuous and no pour joints shall show. Before a pour is started, make certain that adequate equipment, men and concrete will be available to pour in cycles which will permit proper and thorough integration of each layer of concrete. Upon stopping off a pour, the top surface shall be on a level. Points of deposit in walls shall be so spaced that it will not be necessary for concrete to flow laterally more than 24 inches.
- F. No concrete shall be placed for any element until reinforcing for same is fastened in place nor until forms are complete. No concrete shall be placed before work that is to be embedded has been set. Notify other crafts so they may deliver anchors, inserts, etc., or other work to be embedded in ample time and also notify them when their assistance in setting is required. Reinforcing or other materials that have been set in place shall not be disturbed.
- G. No pipes- except electrical conduits 1-1/4" and less in diameter shall be embedded in structural concrete. Before placing concrete, such pipes and large conduits shall be sleeved providing 1/4" clearance (min.) all around Sleeves shall be positioned so as not to impair strength of surrounding elements. Sleeves and inserts will be provided and set under other sections of the work.
- H. Remove debris, mud and water from places to receive concrete.
- I. Install various inserts, anchorages, etc., required by public and private utility companies to accommodate miscellaneous metal items and equipment furnished by them.
- J. Concrete splash and/or grout shall be removed from surfaces that will receive painter's finish.
- K. Place no concrete in water unless written permission has been obtained from Structural Engineer.
- L. Maintain continuous and accurate log of placing of concrete in structure.
- M. Notify Architect 48 hours minimum prior to placing of any concrete.
- N. Provide formed openings where required for work passing through or embedded in concrete members.
- O. Place concrete continuously between expansion joints, control joints, and construction joints.

### 3.3 VIBRATION AND COMPACTION:

- A. Concrete shall be thoroughly compacted by means of internal mechanical vibrators. Such compaction shall be produced as will be obtained by placing the vibrator directly in concrete at 18"-30" intervals for a period of approximately 5 to 15 seconds and withdrawing slowly or as directed, depending on the consistency of concrete. One vibrator will be required for each location where simultaneous placing takes place, to ensure thorough vibrating of all sections. Provide sufficient spare vibrators on the job so as to have them readily available in case any vibrator in use should suddenly cease to function properly. Where spare vibrators are employed, provide additional spares. Under no condition shall vibrator be placed against reinforcing steel or attached to forms. Use no vibrators to transport material.
- B. Vibrator shall be of the flexible immersion type having a frequency of not less than 7,000 rpm.
- C. Voids and rock pockets shall be eliminated.

### 3.4 CONSTRUCTION JOINTS:

- A. Placement of construction joints and the manner in which they are provided for shall be only as approved by Architect or as shown on the Drawings. Construction joints shall be as few as possible and will not be permitted simply to save forms. Submit shop drawings of construction joints showing proposed locations and details. Submit to Architect prior to forming or placing concrete.
- B. Under no condition will construction joints be permitted in exposed concrete surfaces other than where specifically shown and specified.
- C. Construction joints including keys shall be cleaned and roughened by removing entire surface and exposing clean aggregate solidly embedded by means of sandblasting or other approved methods. Forms and reinforcing shall be cleaned of drippings, debris, etc. Just before starting of new pour, horizontal surfaces shall be covered with 1/2"-1" thickness of grout composed of cement and fine aggregate of the same proportion as that used in concrete work, but omitting the 1-1/2" aggregate where 1-1/2" is the maximum size, or 1/2 of the 3/4" aggregate where 3/4" is the maximum size. Proportions will be determined by the testing agency.

3.5 CURING (FORMED CONCRETE): Keep formed concrete surfaces continuously wet both in forms and after removal of forms for at least seven (7) days after placing. Wood forms shall be kept wet. If forms are permitted to be removed prior to expiration of curing period, exposed concrete surfaces shall be kept continuously wet. Application of curing compounds shall conform to requirements of Concrete Finishes Section.

3.6 EQUIPMENT BASES: Verify sizes and shapes required by items specified elsewhere. Concrete bases for special equipment shall be installed in strict accord with Drawing details and the specifications and recommendations of the equipment manufacturer.

### 3.7 EXPANSION JOINT FILLERS:

- A. Asphaltic Filler Joints: Place filler material so that top of surface is level and aligned uniformly 1/4" below adjacent concrete surface. Provide where slabs abut vertical surfaces, at not over 24 ft. centers horizontally in paving and at other locations so noted on Drawings. Follow Drawings for pattern where indicated; where not indicated, coordinate locations with Architect before proceeding.

GROUTING: Grout shall be metallic or non-metallic, non-shrink grout mixed and applied in strict accordance with manufacturer's directions, except use non-metallic only where grouting is exposed in the finished work.

3.8 DEFECTIVE CONCRETE:

- A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by Architect.

END OF SECTION

**SECTION 03 35 00**  
**CONCRETE FINISHING**

**PART 1 - GENERAL**

1.1 DESCRIPTION:

- A. Work Included: All finish required on exposed cast-in-place concrete surfaces including all patching and all curing of cast-in-place concrete (except formed surfaces).
- B. Related Work Specified Elsewhere:
  - 1. Concrete Paving – 32 13 13.
  - 2. Curing of formed concrete: See Cast-In-Place Concrete – 03 30 00.

- 1.2 PROTECTION: Protect exposed surfaces including flat work as required to prevent damage by impact or stains from rubbish and the work of other trades.

**PART 2 - PRODUCTS:**

2.1 MATERIALS:

- A. Curing Materials:
  - 1. Curing Paper: ASTM C 171-69, non-staining waterproof paper, regular type.
  - 2. Curing Compounds: ASTM C 309-74, Type 1, clear resin type free of oil, wax grease, or other substance which might prove deleterious to any material to be applied to concrete. Curing compounds for exposed class shall be a multi-purpose curing-hardener-sealer type equivalent to Sonneborn-Contech "Kure-N-Seal", L&H "Dress & Seal" or Protex "Triple Seal".

**PART 3 - EXECUTION**

3.1 CURING:

- A. All concrete shall be cured by curing paper or curing compounds, all as specified herein.
- B. Curing compounds shall not be used on surfaces when their use may be detrimental to bonding of concrete, Balking and sealants or the specified surface finish or coating. Curing-hardener-sealer type compounds shall be used for exposed slabs.
- C. Curing Compound - General:
  - 1. Application shall commence immediately following completion of specified finishing.
  - 2. When applying compound, the surfaces shall be damp but shall be free from standing water.
  - 3. Surfaces shall be covered with a uniform and even film of compound, as supplied. Using pressurized spray equipment; apply in a single coat to achieve total

- coverage as recommended by manufacturer.
4. When curing compound is applied inside enclosed spaces, adequate Technical ventilation shall be provided and maintained throughout the periods of application.
- D. Paper Curing: All concrete not otherwise permitted to be cured by curing compound shall be paper cured as follows:
1. All slabs shall be saturated such that free moisture occurs over the entire area.
  2. After dampening, slabs shall be immediately covered with curing paper lapped 4 inches at all joints and sealed with adhesive tape or waterproof glue. Curing paper shall remain in place for not less than 10 calendar days. During curing period, scuffed or torn areas shall be promptly recovered with additional papers. Do not use any curing papers which contain a distinct thread design that may leave an impressed pattern on the slab.

### 3.2 PATCHING:

- A. Within 3 days after stripping formwork, all surface defects such as rock pockets, honeycombs, cracks, and holes shall be filled and patched. The Architect shall distinguish between concrete which requires replacement or repair and surface defects which require patching. Permission to patch any area shall not be construed as a waiver of the Architect's right to require complete removal of the defective work if the patching, in his opinion, does not satisfactorily restore the quality and appearance of the surface.
- B. Areas to be patched shall have all loose material chipped away and shall be thoroughly wetted for at least 6 inches entirely surrounding the paths. Coat areas with thin brush coat of fine sand-cement grout followed by patching mortar. Patching mortar shall be prepared of the same material and proportions as used for concrete, except that coarse aggregate shall be removed. Water in the mix shall be kept to a minimum. Mortar shall not be retempered by adding water. Mortar shall be allowed to stand for one hour prior to use and shall be mixed to prevent setting. Mortar shall be compacted thoroughly into place and screeded to leave patch slightly higher than surrounding surfaces and then left undisturbed for 1 to 2 hours to permit initial shrinkage. Patch shall then be finished to match adjacent surface.
- C. Form tie holes shall be solidly filled with patching mortar as specified above and finished to match adjacent surface.
- D. Sack and Patch: Upon completion patches at defects and tie holes, patch all exposed surfaces of the building footing for a uniform texture and appearance.

### 3.3 FINISHES:

- A. Flatwork:
1. Unless otherwise noted or specified, all slabs shall be finished monolithically. Floor slabs which are indicated as sloped to floor drains shall be sloped uniformly so as to provide positive drainage of the indicated areas. Special care shall be taken that a smooth, even joint is obtained between successive pours.
  2. Tolerances:
    - a. Exposed concrete slabs and slabs to receive carpet: 1/8 inch in 8 feet with maximum high and low variance not occurring in less than 16 feet and with 1/16 inch tolerance in any one running foot with no abrupt variations.
    - b. Slabs to receive resilient flooring: 1/8 inch in 10 feet with maximum high and low variance not occurring in less than 20 feet, and with 1/16 inch

tolerance in any one running foot with no abrupt variations.

- c. Slabs to receive tile set with dry-set mortar: 1/4 inch in 10 feet.
3. Trowel Finish (Typical for exposed interior slabs and under carpeting, resilient flooring, and all other areas not specifically noted): After the concrete slab has been screeded to finish grade and float finished, the floating shall be followed by steel troweling after the concrete has hardened sufficiently to prevent excess fine material from working to the surface. Jitterbugs shall not be used where slabs are exposed. The finish shall be brought to a smooth uniform surface free from defects and blemishes. No dry cement or mixture of dry cement and sand shall be sprinkled on the surface.
4. Broom Finish (Typical for exterior site concrete unless noted otherwise): After screeding and floating, the concrete slab shall be given a light steel troweling to seal the surface and remove any irregularities left by the wood float. Just before the concrete becomes non-plastic, the surface of the concrete shall be given a fine broom finish with a broom not less than 18 inches wide. The broom shall be pulled gently over the surface of the concrete from edge to edge. Adjacent strokes shall be slightly overlapped. Unless direction of brooming is indicated on Drawings, brooming shall be perpendicular to the line of traffic and so executed that the corrugations thus produced will be free from porous spots, irregularities, depressions, and small pockets or rough spots such as may be caused by accidentally disturbing particles of coarse aggregate embedded near the surface.
5. The surface of exterior concrete slabs and walks shall be scored as shown on Drawings or as directed by Architect using a tool which will produce a groove 1/4 inch wide at top and a depth of 1/2 inch with rounded corners. All lines shall be straight, parallel, and/or square, all intersections square cut. Edges of slabs shall be rounded in the same manner.
6. Special concrete exterior slab finishes. See Drawings.

B. Exterior Site Curbs:

1. Top surfaces of curbs shall be steel trowel finished as specified for slabs, edges tooled.
2. Face forms shall be removed as soon as concrete has set sufficiently to retain shape. Vertical surfaces exposed in the finish work shall be plastered with cement grout where necessary and troweled smooth.

3.4 DEFECTIVE WORK:

- A. Finish which is not true to line and plane, which is not in conformance with specified finish and appearance requirements, which exceeds specified tolerances, which does not properly connect to adjoining work, which does not slope to drain and which has been improperly cured, will be deemed as defective. All such defective work shall be removed and replaced with proper work meeting Drawing and Specification requirements and at no added cost to the Owner.

3.5 CONTRACTOR SHALL EMPLOY SECURITY FORCES TO PROTECT ALL CONCRETE FINISHES DURING CURING.

- A. Replace all concrete altered or damaged during curing period at no added cost to the Owner.

END OF SECTION

## SECTION 04 00 00

### MASONRY

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION:

- A. Work Included: All concrete block masonry including all reinforcing, grouting and cleaning.
- B. Related Work Specified Elsewhere:
  - 1. Dowels to concrete: See Concrete Reinforcing 03 20 00.
  - 2. Masonry Grouting – 04 05 16.
  - 3. Joint Sealants – 07 92 00.
  - 4. Furnishing of bolts, anchors, flashings, etc., set in masonry: See Section 05 50 00 – Metal Fabrications.
  - 5. Painting and Coating – 09 90 00.

##### 1.2 REFERENCES, CODES AND STANDARDS: The following references, codes and standards are hereby made a part of this Section and all masonry work shall conform to applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.

- A. "Masonry Design Manual", published by International Masonry Industry Advancement Committee.
- B. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- C. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.
- D. California Building Code.
- E. Materials to conform to ASTM C90 – Specification for Load-Bearing Concrete Masonry Units, Current Addition.
- F. Perform work in accordance with ACI 530 and ACI 530.1.

##### 1.3 SUBMITTALS: Comply with requirements of Shop Drawings, Product Data and Samples Section 01 33 00.

- A. Samples: Submit in duplicate for Architect's approval of color, texture and pattern of split-face block.
- B. Certificates: Provide certificates in duplicate verifying that concrete blocks meet the Specifications.

##### 1.4 DELIVERY, HANDLING AND STORAGE:

- A. Do not bring cementitious or other material to the site if it has become lumpy, caked, hardened or air slaked from absorption of moisture.
- B. Handle blocks in manner to prevent chipping and breakage. Protect reinforcing steel from



kinking and bending and from contamination with dirt, mud, oil and other foreign matter detrimental to bond.

- C. Store materials where protected from weather, contact with soil, traffic and construction operations.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS:**

- A. Concrete Block Smooth: ASTM C 90, CBC Standard 21-4, latest edition, Type 1 - moisture controlled, Grade N, load-bearing, two cell, open end and bond beam units where indicated on Drawings or required, fm = 1900 psi.
  - 1. Size: 8" X 8" X 16" nominal.
  - 2. Hollow, Load Bearing Concrete Blocks.
  - 3. Max. Linear Shrinkage (ASTM C 426-70): 0.045%.
  - 4. Min. Tensile Strength: 135 psi.
  - 5. Color: Gray
- B. Concrete Block – Split Face: ASTM C 90, CBC Standard 21-4, latest edition, Type 1 - moisture controlled, Grade N, load-bearing, two cell, open end and bond beam units where indicated on Drawings or required, fm = 1900 psi.
  - 1. Size: 8" X 8" X 16" nominal.
  - 2. Hollow, Load Bearing Concrete Blocks.
  - 3. Minimum Linear Shrinkage (ASTM C426-70) 0.045%
  - 4. Minimum Tensile Strength: 135 PSI
  - 5. Color: Selected from Manufacturer's standard colors.
- C. Concrete Block – Split Face: ASTM C 90, CBC Standard 21-4, latest edition, Type 1 - moisture controlled, Grade N, load-bearing, two cell, open end and bond beam units where indicated on Drawings or required, fm = 1900 psi.
  - 1. Size: 8" X 8" X 8" nominal.
  - 2. Hollow, Load Bearing Concrete Blocks.
  - 3. Minimum Linear Shrinkage (ASTM C426-70) 0.045%
  - 4. Minimum Tensile Strength: 135 PSI
  - 5. Color: Selected from Manufacturer's standard colors.
- D. CAP CMU: 2" thick X 8" X 16" nominal and or 2" X 8" X 8" nominal, solid, color to match CMU below.
- E. Reinforcing Steel: Conform to requirements of Drawings and Concrete Reinforcement Section. Provide positioning devices or other approved means for maintaining vertical and horizontal reinforcing in the locations indicated on the Drawings. Devices shall occur at top and bottom of vertical steel and at intermediate points not to exceed 192 bar diameters.
- F. Mortar: Mixture ingredients in quantities needed for immediate use per ASTM C279. Mortar aggregate to be standard masonry types and comply with ASTM C144
- G. Grout: Engineered Masonry 2000 psi strength at 28 days; 8 to 11 inch slump. Grout aggregate to conform with ASTM C404.
- H. Preformed Control Joints: Rubber Material. Provide with corner and tee accessories, heat

fused joints.

- I. Joint Filler: Closed cell polyvinyl chloride oversized 50 percent to joint width; self expanding.
- J. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.
- K. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, recommended by masonry unit manufacturer.
- L. Masonry sealer. Anti-graffiti type. See Paint Schedule Section 09900 – Painting.

### **PART 3 - EXECUTION**

3.1 PREPARATION: Clean and roughen all concrete at bonding surface, sandblasting where required. Bend dowels into proper alignment, straight and unkinked.

3.2 CONSTRUCTION:

- A. Construct all concrete block masonry in accordance with Reference Standards except where otherwise qualified or modified herein. Where standards conflict, assume the more stringent condition.
- B. Bond Pattern and Joint Treatment:
  - 1. Split-Face Blocks: Common running bond with nominal 3/8" wide joints: rodded where exposed on split-face side.
  - 2. Smooth Blocks: Common running bond with nominal joint to match single score of block and struck flush.
- C. Masonry units shall not be wet prior to laying.
- D. Set masonry units plumb, true to line, with level courses accurately spaced. Keep bond pattern plumb and in alignment full height of wall, corners and reveals plumb and true. Do not use line pins unless absolutely necessary and, if used, fill holes immediately with mortar when pin is withdrawn. Do all cutting of facing units with a power driven Carborundum saw. No chipped faces, corners or edges permitted.
- E. Lay block with head and bed joints solidly filled with mortar for a distance in from the face of the unit equal to the thickness of the face shell.
- F. Provide cleanouts at bottom of all grouted cells except that cleanouts are not required in walls four feet high and less where "low-lift" grouting is employed. Where cleanouts are required to occur on exposed masonry surface, remove entire face shell. Fill grout using low lift method. Maximum lift 4'-0".
- G. Build in all anchors, inserts, bolts, flashings, frames, etc., furnished by others, as the work progresses.
- H. Lay all blocks to preserve unobstructed vertical continuity of cells.
- I. Remove all overhanging mortar or obstructions from inside of cells to be grouted using high pressure jet stream or approved mechanical means.
- J. Use 8" X 8" X 8" CMU units at curved areas.

3.3 GROUTING COMPONENTS:

- A. Fill all cells with grout. Grout spaces shall not be wet at the time grout is placed. Spaces to be filled with grout shall be free from debris, mortar, etc. before filling.
- B. Reinforce bond beam and pilasters as detailed in the plans.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensional position.
- D. Place and consolidate grout fill without displacing reinforcing.

3.4 BUILT-IN WORK:

- A. As work progresses, install built-in work furnished by other Sections.

3.5 TOLERANCES:

- A. Maximum Variation from Plumb: ¼ inch per story non-cumulative; 1/2 inch, two stories or more.
- B. Maximum Variation from Level Coursing: 1/8 inch in 3 ft.; 1/4 inch in 10 ft.; and 1/2 inch in 30 ft.

3.6 CUTTING AND FITTING:

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

3.7 CLEANING: Clean all work as it progresses keeping exposed finished portions of the work free of soil and mortar stains. Use no acid cleaners. All colored, split-face blocks shall be cleaned by sandblasting as follows:

- A. All sandblasting shall be done by experienced mechanics using equipment suitable for purpose and as required to provide a uniform overall surface.
- B. Sandblasting shall be done after walls are thoroughly dry and cured. Sandblasting shall be as light as possible but sufficient to clean surface. Extreme care shall be taken not to cut into blocks or joints and extreme care shall be taken in the blasting of split-face, scored surfaces so as not to erode the surface. Lap strokes to maintain an even surface.
- C. Equipment:
  - 1. Abrasive: Sharp sand, 30-40 mesh.
  - 2. Pressure: 80-90 pounds.
  - 3. Nozzle: 3/8" minimum.
  - 4. Distance From Wall: 36" minimum and at right angles to surface.
- D. Protect all surrounding surfaces from damage due to sandblasting. Clean up all sand and debris from operations and remove from site.

3.8 FIELD QUALITY CONTROL:

- A. Tests and inspections shall be performed by qualified individuals, engineering companies or testing laboratories who shall perform those special inspections required by the

California Building Code, those tests and inspections specified below and such other tests and inspections as the Architect or Owner may require to establish the acceptability of the Work. Testing and inspection services shall be retained by the Owner at the Owner's expense. When tests or inspections reveal failure of materials to meet contract requirements, all costs for subsequent tests and inspections will be paid by the Contractor.

- B. Concrete block masonry is subject to special inspection by testing agency at Owner's expense.
- C. Contractor shall furnish all materials required for analysis of masonry work.

### 3.9 FINISH

- A. The exposed exterior surfaces of masonry work shall receive a masonry sealer and Anti-Graffiti coating.

END OF SECTION

## SECTION 04 05 16

### MASONRY AND GROUTING

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION:

- A. Mortar and grout for masonry.
- B. Related work specified elsewhere:
  - 1. Concrete Reinforcing – 03 20 00.
  - 2. Masonry – 04 00 00.

##### 1.2 SUBMITTALS: Comply with requirements of Shop Drawings, Product Data and Samples Section 01 33 00.

##### 1.3 QUALITY ASSURANCE:

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

##### 1.4 ENVIRONMENTAL REQUIREMENTS:

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- B. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS:

- A. Masonry Cement: ASTM C150 Type I or II.
- B. Mortar Aggregate: ASTM C144, standard masonry type.
- C. Hydrated Lime: ASTM C207.
- D. Grout Aggregate: ASTM C404.
- E. Water: Clean and potable.
- F. Bonding Agent: Epoxy type.

##### 2.2 MORTAR MIXES:

- A. Mortar: ASTM C270, Type S using the Property Method.

##### 2.3 MORTAR MIXING:

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.

- B. Add mortar color and admixtures in accordance with manufacturer's instructions, to match block color.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.

2.4 GROUT MIXES:

- A. Engineered Masonry 2000 psi strength at 28 days; 8-11 inches slump, unless noted otherwise on the structural drawings.

2.5 GROUT MIXING:

- A. Mix grout in accordance with ASTM C94.

2.6 MIX TESTS:

- A. Test mortar and grout in accordance with the Special Inspection Requirements specified by the plans.
- B. Testing of Mortar Mix: In accordance with ASTM C780.
- C. Testing of Grout Mix: In accordance with ASTM C1019.

**PART 3 - EXECUTION**

3.1 EXAMINATION AND PREPARATION: Not used.

3.2 INSTALLATION:

- A. Install mortar in accordance with ASTM C780.
- B. Work grout into masonry cores and cavities to eliminate voids. Do not displace reinforcement.

END OF SECTION

## SECTION 05 12 00

### STRUCTURAL STEEL FRAMING\*

#### PART 1 – GENERAL

**\*In cases of conflict with DSA approved design, the DSA approved design shall be used.**

##### 1.1 WORK INCLUDED:

- A. Structural Steel as indicated on Structural Drawings. This section also includes anchor bolts, deck supports, and hoisting metal deck.

##### 1.2 RELATED WORK:

- A. Quality Control – 01 45 00.
- B. Testing and Inspecting Services – 01 45 23.
- C. Concrete Forming – 03 11 00.
- D. Cast-in-Place Concrete – 03 30 00.
- E. Metal Fabrications – 05 50 00.

##### 1.3 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with applicable provisions of the following; latest editions unless otherwise specified.
  - 1. "Specification for Structural Steel Buildings" by the American Institute of Steel Construction (AISC) dated March 9, 2005. Seismic provisions for Structural steel Buildings.
  - 2. "Code of Standard Practice for Steel Buildings and Bridges" by the AISC. Delete the following sentence from paragraph 4.2.1: "This approval constitutes the Owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings."
  - 3. "Structural Welding Code: Steel", 2004 edition, D1.1 by the American Welding Society (AWS).
  - 4. "Specifications for Structural Joints using ASTM A-325 or A-490 Bolts", by the Research Council on Riveted and Bolted Structural Joints.
  - 5. "California Building Code", 2007 Edition with Amendments.
  - 6. Steel Structure Painting Council (SSPC) Surface Preparation Specifications.

##### 1.4 TESTS AND INSPECTIONS:

- A. Testing Agency: An inspection and testing agency shall be retained by the Owner for testing and inspection as required by drawings and specifications. Selected agency will follow requirements of ASTM E329, "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction".
- B. Tests and inspections shall be performed and paid for as specified in Section 01 45 23.

Materials and work shall be subject to inspection at mill, fabricating plant, and building site.

Material or workmanship not complying fully with drawings and specifications will not be accepted. Give laboratory reasonable notice when ready for inspection. No additional compensation will be paid for any work required to prepare for testing and inspection.

1.5 SUBMITTALS:

- A. Submit the following in accordance with General Requirements.
- B. Shop Drawings: Show fabrication, assembly, and erection details, sizes of members, fastenings, supports and anchors, patterns, clearances, and necessary connections to work of other trades. Obtain approval before beginning fabrication of delivery.
- C. Certifications:
  - 1. Steel: Furnish certified mill analyses and test reports establishing conformity to this specification for each heat prior to fabrication. Include names and locations of mills and shops, and chemical analysis and physical properties of steel.
  - 2. High Strength Bolts: Furnish certified test reports for each lot of bolts in accordance with Paragraph 7, ASTM A325.
  - 3. Paint Products: Furnish certificates of compliance from the paint manufacturer attesting that paint products meet the requirements of this specification.
  - 4. Welders: Furnish copies of welders certification.
- D. Submit Welding Procedure Specifications.

**PART 2 - PRODUCTS**

2.1 MATERIALS:

- A. In general, material shall be of exact sizes, shapes, weight, and kinds provided for on drawings and specifications. However, with written permission of Architect & DSA, members built up from plates may be substituted for rolled shapes, at no additional cost to Owner, provided physical properties of original member such as section modulus, moment of inertia, etc., are met, and provided welding inspection costs associated with substitute built-up member are furnished at no additional cost to Owner.
- B. Structural Steel, Plates, Shapes and Bars: New materials, conforming to ASTM A36, A992 Grade 50, and A913 Gr 65 as noted on drawings. Requirements for delivery shall conform to ASTM A6.
- C. High Strength Bolts, Nuts and Washers ASTM A325, Type 1.
- D. Load Indicator Washers: Coronet Load Indicators are required on all HSB connections.
- E. Machine Bolts: ASTM A307.
- F. Arc-Welding Electrodes: Conforming to AWS D1.1 for filler metal requirements, and recommended by their manufacturers for position and other conditions of actual use. Charpy Impact Testing shall be performed for each type of filler material. A minimum of 20 foot pounds (at -20 degrees) energy value is required.
- G. Steel Tubing: Cold formed, ASTM 500 Grade B.
- H. Paint: SSPC PS 2.03 or Federal Specification TT-P-86, Type II, (Tnemec #99).
- I. Welded Studs: Studs shall be manufactured of C-1015 cold rolled steel conforming to ASTM A108.



- J. Galvanizing: Hot dip process; ASTM A123, to average weight of 2.3 oz./sq.ft. and minimum weight of 2.0 oz.
- K. Pipe Columns: ASTM A53 Grade B.

## 2.2 FABRICATION:

- A. Structural Steel Fabrication: Comply with AISC "Specification for Structural Steel Buildings", latest edition.
- B. Drill or punch holes for bolts. Do not make or enlarge holes by burning.
- C. Shop Connections: Made by bolting or welding, as detailed on drawings. If type of fasteners are not shown, use HS-A325 with load indicator washers.
- D. Welding, Shop and Field: Weld by shielded arc method, submerged arc method, flux cored arc method, or other method approved by AWS. Perform welding in accordance with AWS Code. All welders, both manual and automatic, must be certified in accordance with AWS "Standard Qualification Procedure: for the work to be done. See paragraph "Welding" herein, for detailed requirements. If sizes of fillet welds are not shown on drawings, use AWS minimum weld size but not less than 3/16 inch fillet welds.
- E. Automatic End Welded Studs: Install in accordance with manufacturer's recommendations, with special equipment approved by manufacturer of studs.
- F. High Strength Bolts: Install in accordance with requirements of ASTM A325. Connection shall be with threads excluded from the shear plane. If slip critical, indicate as SC and provide surface prep classification & requirements per RCSC specifications.
- G. Prior to fabrication, straighten all material by methods which will not injure material. Prior to assembling component parts of a connection, thoroughly clean all contact surfaces of loose scale, rust, burrs, etc., and remove local twists and bends.
- H. Surface Preparation:
  - 1. After fabrication, inspection, and acceptance; and before leaving shop, clean all steelwork to be encased in concrete or spray fireproofing by hand wire brushing, or by other means, elected by the fabricator, of loose mill scale, rust, weld slag or flux deposit, dirt and foreign matter in accordance with SSPC-SP-2. Remove oil and grease deposits by solvents.
  - 2. Steelwork to be left exposed and which will be painted shall be cleaned by blast cleaning in accordance with SSPC-SP-7. Remove oil and grease deposits by solvent, SSPC-SP-1.
  - 3. Clean and grind all areas subject to ultrasonic or radiographic inspection.
  - 4. Surfaces within two inches of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.

## 2.3 SHOP PRIME PAINTING:

- A. Shop prime paint any structural steel which will NOT be encased in concrete, covered with sprayed fireproofing or plaster, or receive composite beam welded studs, or specifically noted, with one coat of specified primer. Include all parts of braces, brackets, and similar items. Do not shop prime surfaces to be galvanized, machined surfaces, contact surfaces, and edges and surface areas adjacent to field welds. Apply two coats to parts inaccessible after assembly or erection.

## **PART 3 - EXECUTION:**

### **3.1 INSTALLATION:**

- A. Erect structural steel with proper equipment and qualified riggers.
- B. Actively cooperate with other trades and provide incidental welding, connections, etc. for securement of work of others to structural steel framing.
- C. Erect temporary flooring, planking, and scaffolding necessary in connection with erection of structural steel or support of erection machinery. Use of temporary floors shall be as required by municipal or state laws and governing safety regulations. Hoist metal deck onto structural frame.
- D. After erection, clean connections and abrasions to shop coat and spot paint with same primer used in shop.

### **3.2 ERECTION TOLERANCES:**

- A. Erection tolerances for structural steel work shall be in accordance with latest AISC "Code of Standard Practice for Steel Buildings and Bridges".

### **3.3 BOLTING:**

- A. High strength steel bolts shall be used where indicated. Fabrication and erection shall be in strict accordance with the latest edition of "Specifications for Assembly of Structural Joints Using High-Strength Steel Bolts", as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation. Load indicator washer shall be used. Use beveled washers on sloping surfaces.

### **3.4 WELDING:**

- A. Welding and welded joints shall be in accordance with AWS standards. Work shall be performed by operators who have been qualified by test in accordance with AWS D1.1, "Structural Welding Code – Steel", to perform type of work required for this project.
- B. All methods, sequence, qualifications and procedures, including preheating, postheating, etc. shall be detailed in writing and submitted to Architect for review by the testing laboratory. Provisions shall be made in detailing of lengths of members for dimensional changes as a result of shrinkage stresses so as to provide specified finished dimensions.
- C. Remove all runoff tabs, and bottom backing bars. Top backup bars to be removed or have continuous fillet weld to column.

### **3.5 ANCHOR BOLTS:**

- A. Provide at site, for others to install, all anchor bolts, bearing plates, and templates to be embedded in concrete.
- B. Provide necessary steel templates and diagrams for setting and securing of such anchor bolts in concrete forms.
- C. Be jointly responsible with others for proper locating and installing, and make good any deficiencies and errors.

- D. Setting of anchor bolts in hardened concrete necessitates drilled holes solidly grouted in place with epoxy grout. Submit materials and methods for review and approval.

END OF SECTION

## SECTION 05 50 00

### METAL FABRICATIONS\*

#### PART 1 - GENERAL

\*In cases of conflict with DSA approved design, the DSA approved design shall be used.

##### 1.1 DESCRIPTION:

A. Work Included: All items of miscellaneous metal and related accessory items required for the project and which are not specified elsewhere. Such items include, but are not limited to:

1. Metal connectors requiring special fabrication.
2. Sleeves for miscellaneous metal items.
3. Grouting required for setting miscellaneous metal items.
4. 3" diameter pipe for down spouts.
5. Steel channel at trash enclosure gates.
6. Steel angle and metal deck at trash enclosure gate.
7. Bollards.

B. Related Work Specified Elsewhere:

1. Rough Carpentry – 06 10 00.
2. Gypsum Board – 09 29 00.
3. Painting and Coating – 09 90 00.
4. Division 23 for Mechanical work.
5. Division 26 for Electrical work.

1.2 REFERENCES AND STANDARDS: The following references and standards are hereby made a part of this Section and miscellaneous (and ornamental) metal work shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements or governing rules and regulations.

A. "Code for Arc and Gas Welding in Building Construction" of the American Welding Society, AWS D1.1, latest edition with current supplements, revisions and addenda. Welded connections; use standard AWS A2.0 welding symbols. Indicate net weld lengths.

B. "Pipe Railing Manual", published by National Assn. of Architectural Metal Manufacturers (NAAMM).

C. "Metal Bar Grating Manual", published by National Assn. of Architectural Metal Manufacturers (NAAMM).

D. Steel Structures Painting Council (SSPC) Surface Preparation Specifications (Vol. 2, Painting Manual).

1.3 QUALIFICATIONS: Welding procedures, welders, and tackers for structural metal work shall be qualified in accord with CBC.

1.4 SUBMITTALS: Comply with requirements of Shop Drawings, Product Data and Samples Section 01 33 00.

A. Shop Drawings: Shop Drawings shall show dimensions, sizes, thicknesses, gages, finishes, joining, attachments, and relationship of work to adjoining construction. Where

items must fit and coordinate with finished surfaces and/or constructed spaces, take measurements at site and not from Drawings. Where materials must be set to exact locations to receive work, furnish assistance and direction necessary to permit other trades to properly locate their work. Where welded connectors and inserts are required to receive work, shop drawings shall show exact locations required, and all such drawings shall be furnished to the trades responsible for installing the connectors or inserts. Catalog work sheets showing illustrated cuts of item to be furnished, scale details and dimensions may be submitted for standard manufactured items. Design shop drawings under direct supervision of professional engineer experienced in design of this work, licensed in the State of California.

## **PART 2 - PRODUCTS**

### **2.1 BASIC MATERIALS AND ACCESSORIES:**

- A. Standard Structural Steel Shapes, Bars and Plates: ASTM A 36, latest edition and ASTM A 283, latest edition.
- B. Architectural and Miscellaneous Steel Items: ASTM A 283, latest edition, grade optional.
- C. Steel Tubing: ASTM A 500, latest edition (cold formed) Grade A or B or ASTM A 501, latest edition (hot formed), welded or seamless.
- D. Steel Pipe: ASTM A 53, latest edition, Type E or S. Grade B for structural pipe; Grade A or Type F for railings where bending is required.
- E. Sheet Steel: ASTM A 653, structural steel classification with galvanized coating.
- F. Fastenings (General): Furnish all bolts, nuts, screws, clips, washers and any other fastenings necessary for proper erection of items specified herein. Use stainless steel or hot dip galvanized on exterior. On interior, match adjacent material. Bolts, ASTM Grade A 307.
- G. Welding Electrodes: As permitted by AWS Code D1.1. Where exposed, select filler metal to match base metal. Use E70xx electrodes.
- H. Paint (Primer): Fed. Spec. TT-P-86, Type II or TT-P-645 (zinc chromate ).
- I. Non-Shrink Grout: Sauereisen No. F-100, Sonneborn-Contech "Fondag", Upco "Upcon", 5-Star, Master Builders "Masterflow 713", or approved equal, non-metallic, non-staining, premixed grout having a min. compressive strength of 6,800 psi (28 days).
- J. Pipe: 3" ID steel pipe. Painted galvanized for downspouts.
- K. Bollard: 6" OD steel pipe, filled solid with 2500 psi concrete.
- L. Metal deck: Box rib, galvanized, 16 GA.

### **2.2 SPECIALLY FABRICATED PRODUCTS:**

- A. Metal Ladders: Unless otherwise indicated on the Drawings, metal ladders shall be of welded steel construction with 2" x 3/8" (min.) flat steel bar rails approximately 24" apart with 3/4" round steel bar rungs spaced approximately 12" o.c., let into rails and fully welded in place. Provide welded angle brackets at top, bottom and at intermediate supports not to exceed 6 foot spacing. Securely fasten to building structure. Ladders

shall conform to requirements of General Industrial Safety Orders, Division of Industrial Safety, State of California. Stock aluminum fixed ladders manufactured by Precision Stair Corporation, Model TL-174., or approved equal, and conforming to above dimensions and safety requirements are acceptable.

- 2.3 FINISHES: (Except as otherwise noted on the drawings or specified).
- A. Exterior Ferrous Metal and Interior Ferrous Metal Exposed to Continuing Moisture: Welds, burrs, and rough surfaces ground smooth after fabrication and completed assembly given one shop prime coat of paint.
  - B. Interior Ferrous Metal: Welds, burrs, and rough surfaces ground smooth and completed assembly cleaned, hot phosphate treated, and given one shop prime coat of paint. Hot phosphate treatment not required on items which are not exposed in the finished work or on those items where size prohibits such treatment. Indicate on shop drawings where size prohibits such treatment. Indicate on shop drawings where treatment is proposed to be omitted.
  - C. All Exposed Fastenings: Match color and finish of adjacent material.

### **PART 3 - EXECUTION**

3.1 CONDITION OF SURFACES: Inspect all surfaces to receive metal work and report all defects which would interfere with the installation to the Architect. Starting work implies acceptance of surfaces as satisfactory.

3.2 WORKMANSHIP:

- A. General Requirements:
  - 1. Verify all measurements at job.
  - 2. Coordinate all metal work with adjoining work for details of attachment, fittings, etc. Do all cutting, shearing, drilling, punching, threading, tapping, etc., required for metal or for attachment of adjacent work. Drill or punch holes; do not use cutting torch. Shearing and punching shall leave true lines and surfaces.
  - 3. Conceal all fastenings where practical. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Form joints exposed to weather to exclude water.
  - 4. Make all permanent connections in ferrous metal surfaces using welds whereat all possible; do not use bolts or screws where they can be avoided.
  - 5. Provide all lugs, clips, anchors, and miscellaneous fastenings necessary for the complete assembly and installation.
  - 6. Set all work plumb, true, rigid, and neatly trimmed out. Miter corners and angles of exposed moldings and frames unless otherwise noted.
  - 7. Do all grouting of frames, plates, sills, bolts, and similar items with non-shrink grout.
  - 8. Where items must be incorporated or built into adjacent work, deliver to trade responsible for such work in sufficient time that progress of work is not delayed. Be responsible for proper location of such items.
  - 9. Protect all dissimilar metals from galvanic corrosion.
- B. Welding:
  - 1. Perform all welding in accord with AWS Code D 1.1.
  - 2. Welds shall be made only by operators experienced in performing the type of work indicated.

3. Welds normally exposed to view in the finished work shall be uniformly made and ground smooth.
4. Where welding is done in proximity to glass or finished surfaces, such surfaces

C. Bolted, Screwed, and Riveted Connections:

1. In general, use bolts for field connections only and then only as detailed. Provide washers under all heads and nuts bearing on wood. Draw all nuts tight and upset threads of permanent connections to prevent loosening. Use beveled washers where bearing is on sloped surfaces.
2. Where screws must be used for permanent connections in ferrous metal, use flat head type, countersunk, with screw slots filled and finished smooth and flush.
3. Where rivets are used, they shall be machine driven tight, heads centered, countersunk, and finished flush and smooth.

D. Surface Treatment and Protective Coatings:

1. Cleaning: Thoroughly clean all mill scale, rust, dirt, grease and other foreign matter from ferrous metal prior to any galvanizing, hot phosphate treatment or painting. Conditions which are too severe to be removed by hand cleaning methods shall be cleaned as per SSPC "Surface Preparation Specifications", "Solvent Cleaning, SSPC-SP1-63"; "Power Tool Cleaning, SSPC-SP 3-36"; or "Brush-Off Blast Cleaning, SSPC-SP 7-63", as required.
2. Hot Phosphate Treatment: Conform to SSPC-PT-4.
3. Painting: After material has been properly cleaned and treated, apply shop prime coat of paint to all surfaces except those encased in concrete or masonry. Apply all paint as per manufacturer's directions. Spot paint all abrasions and field connections after assembly. Shop coat shall be dry prior to shipment to job site. Unless otherwise specified or directed, do not apply shop prime coats or any stenciled or painted identification markings to any galvanized surfaces.
4. Galvanizing: Conform to ASTM A 123 for rolled, pressed and forged shapes, plates, bar and strip; A 153 for hardware items and A 123 for assembled steel products. Conform to ASTM A 384-76 and A 385-76 (Recommended Practices) pertaining to galvanized assembled steel products. Unless otherwise permitted, do all galvanizing after fabrication, in largest sections practicable. Where galvanizing is removed by welding or other assembly procedure, touch-up abraded areas with molten zinc or zinc-rich paint.

3.3 PROTECTION AND CLEANING: Remove all soil and foreign matter from finished surfaces and apply such protective measures as may be required to prevent damage or discoloration of any kind until acceptance of project. Protection of work and initial cleaning shall be the responsibility of each installer or erector until the installation is completed, whereupon the responsibility for subsequent protection and final cleaning shall pass to the General Contractor for the entire project. Remove protective coverings prior to acceptance of Work.

END OF SECTION

## SECTION 09 24 00

### PORTLAND CEMENT PLASTERING

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION:

- A. Work Included: All plastering work required for the project to receive a paint finish.
- B. Related Work Specified Elsewhere:
  - 1. Metal Roof Accessories – 07 61 00.
  - 2. Joint Sealants – 07 92 00.
  - 3. Metal Doors and Frames – 08 11 00.
  - 4. Windows – 08 50 00.
  - 5. Lath – 09 22 36.
  - 6. Painting and Coating – 09 90 00.
  - 7. Mechanical and Electrical Divisions.

##### 1.2 REFERENCES, CODES AND STANDARDS: The following references, codes and standards are hereby made a part of this Section and all plastering work shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing in the Drawings or these Specifications shall be construed as permitting work which is contrary to code requirements.

- A. "Reference Specifications for Lathing, Furring and Plastering in California" published by California Lathing and Plastering Contractors' Assn., Inc., latest edition.
- B. California Building Code, 2007 Edition, Chapter 25, Part 2, Volume1.

##### 1.3 FIRE RATED ASSEMBLIES: All fire rated plaster assemblies, including materials and methods of application used, shall be approved by the Building Code.

##### 1.4 SUBMITTALS: Comply with requirements Section 01 33 00.

- A. Samples: Submit samples for approval of all textured plaster finishes, 12" x 12" minimum size for each different colors, for Paint 1 and Paint 2, color as selected by Architect sample.
- B. Color selections for integrate color finish coat.

##### 1.5 DELIVERY AND STORAGE OF MATERIALS: Only unopened packages of material (except aggregates) bearing manufacturer's and brand names will be permitted. Store cement and lime under watertight cover away from sweating walls and damp surfaces until ready for use. Remove from site any damaged or deteriorated materials.

##### 1.6 PROTECTION: Protect all adjacent finishes and surfaces from damage or stains during plastering operations. Where machine application of plaster is employed, adjacent surfaces shall be masked or similarly protected and all overspray and droppings removed before material sets. Particular attention shall be paid to protection of glass and metal surfaces against etching caused by alkaline materials and moisture runoff or drainage therefrom.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS:



- A. Stucco Finish Coat: Formulated for machine application, mill-mixed and waterproofed.
- B. Lime: ASTM C 206, Type "S" finishing hydrate.
- C. Portland Cement: ASTM C 150, Type II. Plastic cement not acceptable.
- D. Aggregates: Sand for Portland Cement Plaster: ANS A 42.2, natural or manufactured sand graded as follows:

Percent Retained Each Sieve

Sieve Size	Min.	Max.
#4	95	100
#8	70	90
#16	30	16
#30	30	65
#50	70	90
#100	95	100

- E. Fiber Reinforcement: Chopped strands of alkali-resistant polypropylene fiber, ASTM C 116, ½ inch long, for use in scratch coat only.
- F. Water: Clean and potable, free of silt and impurities detrimental to plaster.

2.2 PLASTER PROPORTIONS:

- A. Portland Cement Plaster:
  1. Scratch and Brown Coats (By Volume): 1 part Portland Cement, 3-1/2 to 4-1/2 parts sand, 1/10 part maximum dry hydrated lime or equivalent in lime putty.
  2. The finish coat shall be integral colors selected from manufacturer's standard colors by La Habra Stucco or Davis Colors..
  3. The finish coat shall be La Habra Acrylic Finish Medium Finish.

**PART 3 - EXECUTION**

3.1 CONDITION OF SURFACES:

- A. Inspect all surfaces to receive plaster finishes and report all defects. Starting work implies acceptance of surfaces as satisfactory.
- B. Apply no plaster to concrete or masonry surfaces which have been coated with bituminous compounds or other detrimental waterproofing agents.
- C. Examine all grounds, beads, screeds, etc., and determine that they are straight, curved, plumb, level or square as required.

3.2 PREPARATION: Properly prepare all surfaces to receive plaster in accord with manufacturer's directions and the requirements of the listed References, Codes and Standards documents.

3.3 INSTALLATION:

- A. General:

1. Methods of mixing and application of plaster shall conform to requirements of the listed References, Codes and Standards documents and the specifications of particular products or systems.
2. Scratch coat ingredients shall include polypropylene fiber reinforcement at the rate of 1 (one) pound per 94 pound bag of cement comply with the manufacturer's recommendations.
3. Measure all material for plastering work in calibrated measuring boxes. Shovel measurement is not acceptable.
4. Make overnight jointing at natural breaking points such as vertical rises, expansion joints, angles, and changes in plane. Each coat of plaster for an entire surface from top to bottom and between natural breaking points shall be applied in one day.
5. Where basecoat plaster finishes flush with metal frames, etc., cut plaster free from such materials before "set". Neatly groove finish coat at such junctions.

B. Application - Portland Cement Plaster:

1. Unless otherwise noted, apply plaster on metal lath in 3 coats with a minimum thickness of 7/8", finished face to back of lath.
2. Do all leveling of scratch and brown coats of Portland Cement plaster surfaces with a straightedge (rod) only and not with a darby or float.
3. Not less than 48 hours shall elapse between application of scratch and brown coats and not less than 14 (fourteen) days between application of brown and finish coats.
4. Moist cure base coat when ambient temperature is 77 degrees F or higher and/or when the relative humidity is 70%, and the conditions are windy.
5. Moist cure each base coat of plaster for not less than 48 hours, only when the base coat is set and is hard.. In hot, dry, windy weather, fog spray periodically as required to prevent dryouts, glazed areas and bloom. Cover with polypropylene sheets to retard evaporation during extreme weather conditions.
6. Do not moist cure base coat subject to freezing.
7. Apply finish coats over uniformly damp surfaces free of surface water.
8. Do not moist cure finish coat except in severe climatic conditions, such as extreme heat, strong winds, and low relative humidity and in compliance with the finish coat manufacturer instructions.
9. Separate all structural members, outlet boxes, frames, louvers, and similar penetrations from the plaster by a neat trowel cut.

C. Surfaces and Tolerances: Finish all exposed surfaces true and even, without objectionable waves, cracks, or imperfections. Provide plaster suitable to form proper foundation for trim, moldings, paint and other finishing materials.

3.4 PATCHING: Prior to acceptance of the project, all damage, cracks, checks, discolorations and other imperfections in the work, including damage caused by other trades and damage due to shrinkage and minor structure movements of the building, shall be cut out full depth and patched to match adjoining surfaces. Costs for repair of damage caused by other trades shall be borne by those responsible for the damage.

3.5 CLEAN UP: Clean up upon completion in accordance with Division 1.

END OF SECTION

**SECTION 09 90 00**  
**PAINTING AND COATING**

**PART 1 - GENERAL**

1.1 DESCRIPTION:

- A. Work included: Surface preparation, paint and finish the exterior and interior exposed surfaces listed on the Painting Schedule in Part 3 of this Section, and a high grade as recommended by the paint manufacturer for unlisted surfaces, as specified herein and as needed for a complete and proper installation. All exposed surfaces interior and exterior that do not have a factory finish shall be painted unless noted otherwise. A galvanized coating is not considered a factory finish for the purpose of this section.
- B. Related Work Specified Elsewhere:
  - 1. Joint Sealants – 07 92 00.
  - 2. Metal Doors and Frames – 08 11 00.
  - 3. Wood Doors – 08 14 00.
  - 4. Windows – 08 50 00
  - 5. Portland Cement Plastering – 09 24 00.
  - 6. Gypsum Board – 09 29 00.
  - 7. Taping and cementing of gypsum wallboard: See Gypsum Wallboard – 09 29 00.
  - 8. Mechanical and Electrical Sections.

1.2 REFERENCES:

- A. ANSI/ASTM D16 – Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D2016 – Test Method for Moisture Content of Wood.
- C. State of California Department of Transportation Standard Specifications, Latest Edition.
- D. Regulation 8, Rule 3, of Bay Area Air Quality Management District as it pertains to organic compounds and Architectural coatings.

1.3 DEFINITIONS:

- A. Conform to ANSI/ASTM D16 for interpretation of terms used in this Section.

1.4 QUALITY ASSURANCE:

- A. Product Manufacturer: Company specializing in manufacturing quality paints and finish products with 10 years of experience.
- B. Applicator: Company specializing in commercial painting and finishing with 5 years documented experience approved by product manufacturer.
- C. Workmanship shall be of highest quality in all respects.
- D. Apply paint materials in accordance with manufacturer's specifications and recommendations.
- E. Environmental Conditions: Surfaces are to be painted only when free from moisture. No

painting is to be performed when temperature is below 50 degrees F, except when specifically directed otherwise in writing by the Owner.

1.5 REGULATORY REQUIREMENTS:

- A. Conform to applicable code for flame/fuel/smoke rating requirements for finishes.
- B. Conform to Bay Area Quality Management District requirements.

1.6 SUBMITTALS: Comply with requirements of Shop Drawings, Product Data and Samples Section 01 33 00.

- A. Submit product data for the following items to District for review and approval:
  - 1. List of materials to be used:
    - a. Surface Cleaning Materials.
    - b. Surface Patching and Caulking Materials.
    - c. Painting Material.
  - 2. Manufacturer's technical specifications, M.S.D.S. data sheets and additional information if requested for each painting material listed.
  - 3. Color and Finish Samples: Samples of each color and finish required. Such approved samples will constitute standards for color and finish for acceptance or rejection of completed work. Make samples 8 x 10 inches in size. Furnish six (6) samples of each color and finish. Resubmit additional samples if necessary. Samples are to be labeled on the back side with the name of the project, contractor's name, color name, type of paint, and name of paint manufacturer.
- B. On actual wood surfaces, provide two 4 x 8 inch samples of natural and stained wood finish. Label and identify each as to location and application.
- C. Submit manufacturer's application instructions.
- D. Submit copy of surface moisture test results to the District.
- E. Certification of factory mixed colors from paint manufacturer.

1.7 FIELD SAMPLES:

- A. Provide samples under provisions in Submittals.
- B. On actual wall surfaces and other exterior building components, duplicate painted finishes of prepared samples. Provide full-coat finish samples on at least 100 sq.ft. of surface, as directed. Provide additional samples if necessary to demonstrate the specified sheen, color and texture. Simulate finished lighting conditions for review of in-place work.
- C. Final acceptance of colors will be from samples applied on the job.

1.8 DELIVERY, STORAGE AND HANDLING:

- A. Deliver paint materials to site in manufacturer's original unopened containers with product designation, batch numbers and date of manufacture clearly visible. District Inspector to verify.
- B. Store paint materials and equipment in well-ventilated storage container provided by the contractor and in a location approved by the Owner. Receiving and opening all paint materials will be performed in this room. Keep storage space neat, clean and accessible

at all times. Oily or paint filled rags will be removed and disposed of each day. No paint materials will be left unsecured.

- C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.
- D. Store paint materials in minimum ambient temperature of 45 degrees F, and a maximum of 90 degrees F, in well ventilated area; unless required otherwise by manufacturer's instructions.
- E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

#### 1.9 ENVIRONMENTAL REQUIREMENTS:

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain, or when relative humidity is above 80 percent.
- C. Provide the District with M.S.D.S. data for all products being used, a copy of which is to be posted at the job site.
- D. Minimum Applications Temperatures for Latex Paints: 45 degrees F for interiors, 50 degrees F for exterior unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish and transparent finishes: 65 degrees F for interior or exterior unless required otherwise by manufacturer's instructions.

#### 1.10 EXTRA STOCK:

- A. None required.

#### 1.11 GUARANTEE:

Provide a written guarantee covering the adherence and quality of the finish for a period of three (3) years from the date of final acceptance. Guarantee shall state that the Contractor will refinish without charge to the Owner any portion of the work, including adjacent surfaces if necessary, which evidences blistering, peeling, chalking, change of color, or other noticeable defects within this period.

### **PART 2 - PRODUCTS**

#### 2.1 MANUFACTURERS:

- A. Manufacturer's catalog names and number of paint types in this Section herein are based on products of Benjamin Moore & Company, and is the standard of quality against which the District will judge equivalency. The quantity of titanium dioxide, the use of clays, aluminum silicate, talc and the purity of acrylic materials are a few of the criteria which will be used by the District in determining equivalency of materials.

#### 2.2 MATERIALS:

- A. Coatings: Factory mixed colors. Pigments shall be fully ground; maintaining a soft paste consistency capable of being readily and uniformly dispersed to a homogeneous coating.

- B. Coatings: Good flow and brushing properties, capable of drying or curing free of streaks or sags. Dry film thickness of each coat shall comply with minimum published recommended thickness by the paint manufacturer.
- C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, shall be of commercial quality and approved by paint manufacturer.
- D. All paint materials shall conform to BAAQMD Regulation 8, Rule 3.

2.3 FINISHES:

- A. Refer to schedule at end of Section for surface finish schedule. Color selection packages will identify colors and applications locations for each individual site as issued by the District.

**PART 3 - EXECUTION**

3.1 INSPECTION:

- A. Verify the substrate conditions are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition to the Construction Manager that may potentially affect proper application.
- C. Measure moisture content of surfaces using electronic moisture meter. A maximum of two tests per Elementary School and five tests per High School will be required. Do not apply finishes unless moisture content of surfaces is below the following maximums:
  - 1. Gypsum Wallboard: 12 percent.
  - 2. Interior Located Wood: 15 percent, measured in accordance with ASTM D2016.
  - 3. Exterior Located Wood: 15 percent, measured in accordance with ASTM D2016.
- D. Inspector must review and accept substrate prior to contractor beginning installation.

3.2 GENERAL PREPARATION:

- A. Prior to the start of surface preparation in any area, the following items will be completed to the satisfaction of the District Inspector:
  - 1. Provide protective coverings for all items that are not to be painted.
  - 2. Contractor is to remove metal mesh grills where installed in front of windows and store for future painting and reinstallation. Waterblast for cleaning, then remove window louvers or shades that obstruct the painting of surfaces behind and reinstall.
  - 3. Surfaces not to be painted: Chain link fence, galvanized handrails, except as noted, concrete steps and paving, aluminum windows, hardware, unpainted benches and fences, and other items not presently painted. Items in question are to be brought to the attention of the Project Manager for clarification prior to bidding.
- B. Methods for installation and protection of work: Provide and maintain all lifts, scaffolding, and ladders and drop cloths required for this work. Painted and finished surfaces subject to damage or defacement due to other work on the building will be properly protected and

covered. Contractor will be responsible for any and all damages to painted work and to that of other areas caused by his operation.

- C. No painting or finishing will be started until the surfaces to be painted or finished are in proper condition in every respect, and approved by the District Inspector.  
  
Surfaces to be painted will be clean, dry, sound and free of dirt, rust, grease, traffic scum, dust, loosely adhering paint, surface chalk, staples, tacks, and any other substances which might interfere with the functioning of the painting or coating system.
- D. Remove electrical plates, hardware, light fixture trim, acrylic guards and fittings prior to preparing surfaces or finishing.
- E. Correct defects and clean surfaces which affect work of this Section.
- F. Seal marks such as felt-tipped marking pens, etc. with Benjamin Moore's SPS. Insure that these marks do not bleed through surface finishes.
- G. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- H. Gypsum Board Surfaces: Latex fill minor defects with Benjamin Moore's Lightweight Spackle #057-01. Spot prime defects after repair with Moorcraft Primer Underbody #284.
- I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- J. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting and clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Spot prime after repairs.
- K. Shop Primed Steel Surfaces: Scrape, grind, and sand to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent.  
  
Prime bare steel surfaces. Prime metal items including shop primed items. Areas where all rust cannot be removed, use Benjamin Moore's Rust Converter #M-84-00.
- L. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior Benjamin Moore's Moorlastic 45 year caulking compound after prime coat has been applied.
- M. Exterior Plaster: Allow plaster to cure for 30 days prior to painting.
- N. Metal Doors Scheduled for Painting: Paint exterior face, sides and top, and bottom edges.
- O. Spot prime all repairs, patching and bare substrate prior to application of finish coat.

### 3.3 PROTECTION:

- A. Contractor to protect all concrete walks, landscaping, floors and prefinished materials. Building fixtures and other items are not to be painted.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from

disfiguring other surfaces.

- D. Remove empty paint containers from site at end of each day.

### 3.4 APPLICATION AND WORKMANSHIP:

- A. All painting is to be performed by skilled and experienced mechanics, working under the supervision of a capable foreman. All workmanship shall be of the highest quality and to the complete satisfaction of the District Inspector. All materials shall be applied in accordance with the manufacturer's directions and in compliance with the manufacturer's specifications. All material shall be sprayed and backrolled, evenly brushed or smoothly rolled on without runs or sagging, and free from drips, ridges, laps and brush marks. Ensure that all coats are thoroughly dry before applying succeeding coats. Sand surfaces and dust clean between coats as necessary to produce a smooth finish.
- B. Prime coat shall not be applied until cleaned and District Inspector has approved prepared surfaces. Finish coat of paint shall not be applied until prime coat and patching have been inspected and approved by District Inspector. Prime coat will be tinted lighter than the finish coat.
- C. Putty or caulking will be applied after surface is primed and primer is dry.
- D. Concrete, stucco and plaster surfaces will not be painted until the surface is dry and contains minimum moisture.
- E. Completed painted surfaces will be free of blistering, running, peeling, scaling, streaks and stains, and the colors of all surfaces will remain free from fading.
- F. Graphic lettering will be sized as indicated on drawings and will be solid style.
- G. Paint shop primed equipment. Paint shop prefinished items to colors selected by School District.
- H. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- I. Replace identification markings on mechanical or electrical equipment when painted accidentally.
- J. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.
- K. Paint exposed conduit and electrical equipment occurring in finished areas, including front, sides, and frame of panels.
- L. Reinstall electrical plates, hardware, light fixture trim, and fittings removed prior to finishing. Replace cracked or broken items.
- M. Paint area behind soffit vents and similar conditions. Do not paint over insect screens except as needed to match colors.



- N. Provide a total dry film thickness not less than the specified amount in the finish schedule.

### 3.5 CLEANING, TOUCH UP:

- A. As work proceeds, promptly remove paint where spilled, splashed or splattered.
- B. During progress of work, maintain premises free of accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and material which may constitute a fire hazard. Place in closed metal containers, and remove daily from site.
- D. When cleaning airless or electro-static spray equipment, all cleaning material to be disposed of properly by contractor. No material is to be poured down drains or into the ground.
- E. Upon completion of the painting work, contractor will remove from the premises and dispose of properly all scaffolding and equipment, surplus material, empty containers, and other debris resulting from his operations. The building and surrounding areas shall be left clean and neat in all respects. Do not use school debris boxes for disposal.
- F. Runs, sags, misses, holidays, stains, and other defects in the painted surfaces, including inadequate coverage and mil thickness, shall be satisfactorily touched up, refinished or repainted as necessary.
- G. Contractor will leave all glass areas, stucco surfaces, floors and walls, hardware, and any other surfaces clean and free from any paint, stain, spattering, smears or smudges which are the result of his operation. Contractor will replace any glass damaged in any way by his operations. This will include all glass areas of the buildings. Special cleaning solution must be used on plastic glazing areas. DO NOT SCRAPE PLASTIC GLAZING.

### 3.6 SCHEDULE – EXTERIOR SURFACES:

- A. Cement Plaster:
  - 1. One Prime coat Benjamin Moore All Purpose 100% Acrylic Primer #023.  
Two finish coats Benjamin Moore MoorGard Low Lustre Fortified Acrylic House Paint #103.
- B. Steel – Unprimed:
  - 1. One prime coat Acrylic Metal Primer (M04)  
Dry Mil Film Thickness 1.5 – 2.5
  - 2. One finish coat Acrylic Gloss Enamel, (M28)  
Dry Mil Film Thickness 1.5 – 2.5
- C. Steel – Shop Primed:
  - 1. One prime coat Acrylic Metal Primer (M04)  
Dry Mil Film Thickness 1.5 – 2.5
  - 2. One finish coat Acrylic Gloss Enamel (M28)  
Dry Mil Film Thickness 1.5 – 2.5
- D. Steel – Galvanized:
  - 1. One prime coat Acrylic Metal Primer (M04)

- 2. Dry Mil Film Thickness 1.5 – 2.5  
One finish coat Acrylic Enamel (M28)  
Dry Mil Film Thickness 1.5 – 2.5
- E. Wood Siding, Fascia, Soffit and Trim:
  - 1. One prime coat Fresh Start Alkyd Primer (C024-00/04)  
Dry Mil Film Thickness 1.5 **(or)**  
One prime coat Super Spec Busan 100% Acrylic Exterior Primer  
Dry Mil Film Thickness 1.2
  - 2. Two finish coats # 170 Moorecraft Super Spec Latex House and Trim Paint
- F. Painted Flashing, Louvers, Misc. Metals:
  - 1. One prime coat Acrylic Metal Primer (M04)  
Dry Mil Film Thickness 1.5 – 2.5
  - 2. One coat Acrylic Gloss Enamel (M28)  
Dry Mil Film Thickness 1.5 – 2.5
- G. Metal Doors:
  - 1. One prime coat Fresh Start Alkyd Primer (C024-00/04)  
Dry Mil Film Thickness 1. or  
One Prime coat Acrylic Metal Primer (M04)  
Dry Mil Film Thickness 1.5 – 2.5 as specified
  - 2. Two coats Acrylic Gloss Enamel (M28)  
Dry Mil Film Thickness 1.5 – 2.5
- H. Fire Horns & Bells: RED.
- I. Wood Doors:
  - a. One prime coat Fresh Start Alkyd Primer (C024-00/04)  
Dry Mil Film thickness 1.5 (or)  
One prime coat Super Spec Busan 100% Acrylic Exterior Primer  
Dry Mil Film Thickness 1.2
  - b. Two finish coats # 170 Moorecraft Super Spec Latex House and Trim Paint

### 3.7 SCHEDULE – INTERIOR SURFACES:

- A. Drywall – Flat Finish (all places not covered under Drywall-Semi-Gloss finish)
  - 1. One Prime Coat Benjamin Moore's Super Hide #284  
Dry Mil Thickness .8
  - 2. One or two Finish Coats Super Hide Vinyl Latex Flat #282  
Dry Mil Thickness 1.0 each coat
- B. Drywall – Semi-Gloss Finish (At toilets, kitchen, service area, toilet vestiboles).
  - 1. One Prime Coat Benjamin Moore's Super Spec Enamel Undercoat #253  
Dry Mil Thickness 1.1
  - 2. One or two Finish Coats Super Hide Latex Semi-Gloss Enamel #283  
Dry Mil Thickness 1.0 each coat
- C. Wood – Semi-Gloss Finish

1. One Prime Coat Benjamin Moore's Super Spec Latex Enamel Undercoater#253  
Dry Mil Thickness 1.1
  2. One or two Finish Coats Super Hide Latex Semi-Gloss Enamel #283  
Dry Mil Thickness 1.0 each coat
- D. Ducts, Conduits, J-boxes, Pipes and related supports and brackets
1. One prime coat Benjamin Moore M04 Acrylic Metal Primer
  2. Two Finish Coats # 314 Waterborne Satin Impervo 100% Acrylic
- E. Concrete Floors –
1. Two finish coats Moore's Latex Floor and Patio Enamel, #122. Dry thickness of 0.9 mil each coat. Follow manufacturer's recommendations for surface preparation and finish including use of non-slip additives.

END OF SECTION

## SECTION 26 05 00

### BASIC ELECTRICAL REQUIREMENTS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes: This section provides basic electrical requirements.
- C. Related Sections:
  - 1. Cast-in-Place Concrete – 03 30 00.
  - 2. Painting – 09 90 00.
  - 3. Division 15: Mechanical.

##### 1.2 BASIC ELECTRICAL REQUIREMENTS

- A. Quality Assurance:
  - 1. Workers possessing the skills and experience obtained in performing work of similar scope and complexity shall perform the Work of this Division.
  - 2. Refer to other sections of the Specifications for other qualification requirements.
- B. Drawings and Specifications Coordination:
  - 1. For purposes of clearness and legibility, Drawings are essentially diagrammatic and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer's data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.
  - 2. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduit. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.
  - 3. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.
  - 4. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity.
  - 5. Coordinate electrical Work with all other Work.
- C. Terminology:
  - 1. Signal Systems: Applies to clock, bell, fire alarm, annunciator, sound, public address, buzzer, telephone, television, inter-communication, and security systems.
  - 2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts. Medium voltage: Applies to power systems operating at more than 600 volts.
  - 3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.

- D. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the California Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.
- E. Structural Considerations for Conduit Routing:
1. Where conduits pass through or interfere with any structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, conform to CBC, Part 2, Title 24, Section 1906 A 3 for conduits and pipes embedded in concrete and Section 2320 A 11.10 for notches and bored holes in wood; for steel, as detailed on the structural steel Shop Drawings.
  2. Where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doweled into structure unless otherwise indicated. Underground structures shall include maintenance holes; pull boxes, vaults, and buildings.
  3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled with the conduit nipple or coupling welded to poles. Welds shall be provided by the electric arc process and shall be continuous around nipple or coupling.
- F. Electrically Operated Equipment and Appliances:
1. Furnished Equipment and Appliances:
    - a. Work shall include furnishing and installing wiring enclosures for, and the complete connection of electrically operated equipment and appliances and electrical control devices which are specified to be furnished and installed in this or other sections of the Specifications, wiring enclosures shall be concealed except where exposed Work is indicated on the Drawings.
    - b. Connections shall be provided as necessary to install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets are of incorrect electrical characteristics or any specified equipment fails to operate properly, repair and/or replace the outlet and/or equipment.
  2. Equipment and Appliances Furnished by Others:
    - a. Equipment and appliances indicated on Drawings as "not in contract" (NIC), "furnished by others," or "furnished by the Owner," will be delivered to the Project site. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.
    - b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push-button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete electrical installation. Work shall also include furnishing and installing conduit and boxes for HVAC control systems, furnished under Division 15. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.

- c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.
  - d. Mechanical equipment furnished under other sections, and requiring electrical connection under this section, will be set in place as part of the Work of the section furnishing such equipment unless noted otherwise.
  - e. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.
- G. Protection of Materials:
- 1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.
- H. Cleaning:
- 1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.
  - 2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.
  - 3. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

## **PART 2 - PRODUCTS - NOT USED**

## **PART 3 - EXECUTION**

### **3.1 GENERAL REQUIREMENTS**

- A. Advise the IOR before starting the Work of this Division.
- B. Exposed conduits shall be painted to match the surfaces adjacent to installation. Refer to Section 09900: Painting.
- C. Salvaged materials removed from buildings shall be removed from the Project site as required by the OAR.
- D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected by the IOR. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to students and staff.
- E. Where existing structural walls are cored for new conduit runs, separation between cored holes shall be 3 inches edge to edge from new or existing holes, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. Contractor to verify location of structural steel, rebar, stress cabling, or similar prior to lay out.
- F. Electrical equipment shall be braced and anchored as indicated on the Drawings.

3.2 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose off the Project site.

3.3 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

## SECTION 26 05 01

### BASIC ELECTRICAL MATERIALS AND METHODS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
  - 1. Boxes, enclosures, keys and locks.
  - 2. Receptacles and switches.
  - 3. Identifications and signs.
- C. Related Sections:
  - 1. Section 26 05 00: Basic Electrical Requirements.
  - 2. Section 28 31 00: Fire alarm Systems.
  - 3. Division 25.

#### PART 2 - PRODUCTS

##### 2.1 BOXES, ENCLOSURES, KEYS AND LOCKS

- A. Outlet Boxes and Fittings:
  - 1. Outlet boxes installed in concealed Work shall be galvanized steel, pressed, or welded type, with knockouts.
  - 2. In exposed Work, where conduit runs change direction or size, outlet boxes and conduit fittings shall be cast metal with threaded hubs cast integral with box or fitting.
  - 3. Fittings shall be cast metal and non-corrosive. Ferrous metal fittings shall be cadmium-plated or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of cracks, gas holes, flaws, excessive shrinkage, and burnt-out sand.
  - 4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting installed.
  - 5. Light fixture outlets shall be 4-inch octagon, 4-inch square, 2-1/8 inches deep or larger, depending upon number of conductors or conduits therein. Plaster rings shall be furnished with round opening with 2 ears drilled 2-23/32 inches center to center.
  - 6. For local device outlets provide 4-inch square 2-1/8 inch deep, boxes for single gang, 5-inch square boxes for two-gang, and special solid gang boxes with gang plaster ring for more than 2 switches.
  - 7. For TV outlets, and horns and strobes provide manufacturer's supplied back box as needed. For television outlets, provide 4-gang deep boxes and 4-gang plaster rings.
  - 8. Plaster rings shall be provided on flush-mounted outlet boxes except where otherwise indicated or specified. Plaster rings shall be same depth as



finished surface. Install approved ring extension to obtain depth to finish surface.

9. In existing plywood wall or drywall construction, and where flexible steel conduit is fished into walls, one-gang and 2-gang outlets for wiring devices may be sectional steel boxes with plaster ears. Boxes shall be fastened to plywood with flat-head screws in each plaster ear screw hole. Boxes fastened to gypsum board shall be Gripsite by Raco, or equal.
10. Factory made knockout seals shall be installed to seal box knockouts, which are not intact.
11. Where flexible conduit is extended from flush outlet boxes, provide and install weatherproof universal box extension adapters.

B. Junction and Pull boxes:

1. Junction and pull boxes, in addition to those indicated, shall only be used in compliance with codes, recognized standards, and Contract Documents.
2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsion and deflecting forces. Boxes shall be furnished with auxiliary angle iron framing where necessary to ensure rigidity.
3. Covers shall be fastened to box with a sufficient number of brass machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws if boxes are not installed plumb. Surfaces of pull and junction boxes and covers shall be labeled in black marker ink designating system, panelboard and circuit designation contained in box. In exposed Work, designation shall be installed on inside of pullbox or junction box cover.
4. Weatherproof NEMA 3R pull and junction boxes shall conform to foregoing for interior boxes with following modifications:
  - a. Cover of flush mounting boxes shall be furnished with a weather-tight gasket cemented to, and trimmed even with, cover all around.
  - b. Surface or semi-flush mounting pull and junction boxes shall be UL, or another Nationally Recognized Testing Laboratory (NRTL) listed as rain-tight and shall be furnished complete with threaded conduit hubs.
  - c. Exposed portions of boxes shall be galvanized and finished with one prime coat and one coat of baked-on gray enamel, unless already furnished with factory baked-on finish.
5. Junction and pull boxes shall be rigidly fastened to structure and shall not depend on conduits for support.
6. Underground Concrete Pull Boxes:
  - a. Pre-cast concrete pull boxes. Concrete pull boxes shall be traffic type, reinforced for H-20 wheel loading, pre-cast concrete. Pull boxes with inside dimensions of 2 feet x 3 feet x 3 feet deep shall consist of a base section, top ring, and cover. Base section shall be furnished with 2 knockouts measuring 10 inch x 10 inch in each 3 feet side, and one 20 inch x 20 inch knockout in each 2-foot side. Pull boxes with inside dimension 4 feet x 4 feet x 4 feet deep shall consist of a base section, midsection, topping, and cover. Base section shall be furnished with 2 knockouts measuring 8 inches x 16 inches on each of 2 opposite sides, and one 20 inch x 20 inch knockout on each of other 2 opposite sides. Pull boxes shall be furnished with a minimum of 6-inch diameter sump knockout and one inch diameter ground rod knockout.

In pull boxes, furnish and install cable racks on walls. Racks shall be furnished with 3 porcelain cable holders on vertical steel mounting bars. Pull boxes shall be furnished with 3/4 inch diameter pull irons. Covers shall be traffic-type consisting of steel safety plate bolted to frame. Covers shall be marked as electrical, power, or signal as required. Pull boxes shall be as manufactured by Quickset, or equal.

- b. Provide end bells in duct entrances. Terminate each metal conduit with insulated bushing provided with a grounding terminal.
  - c. Install pulling irons on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.
  - d. Remove floor drain knockout and provide a depth of 24 inches of crushed rock below box extending a minimum of 12 inches beyond on all sides.
  - e. Permanently and effectively ground metal equipment cases, cable racks, and similar items in pull boxes to site grounding electrode system. Provide grounding conductor in compliance with CEC Article 250.
  - f. Provide 6-inch deep sand base under pull boxes.
  - g. Identify power and signal cables by tagging in manholes and pull boxes. Tie securely to cables with nylon cord.
  - h. Top of steel plate shall provide a minimum coefficient of static friction of 0.5 for either wet or dry locations, when tested for any shoe sole material. Test shall comply with ASTM D 1047 or F 489 or F 609 standards. Submit manufacturer's test results for Architect's review as part of materials and equipment submittals.
7. Underground utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover with finger hole, size as indicated on Drawings. Utility boxes shall be as manufactured by Quickset, or equal.
8. Manholes, vaults, and pull boxes required by a utility company, and installed as part of this Contract, shall meet requirements of servicing utility company.

C. Keys and Locks:

- 1. Provide 2 keys with furnished door locks, including cabinet door locks and switchboard locks, 2 keys for lock switches on switchboards or control panels, and 2 keys with interlocks or other furnished lock switches. Deliver keys to IOR.
- 2. Locks shall be keyed to Corbin No. 60 keys for access to operate equipment and Corbin 70 keys for service access. Special keys and locks shall only be provided where specified.

2.2 RECEPTACLES AND SWITCHES

A. Receptacles:

- 1. Duplex receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wired with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be PVC. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts.

<u>NEMA #</u>	<u>Pass &amp; Seymour</u>	<u>Hubbell</u>
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	<u>Leviton</u>	
(20 amps) NEMA 5-20	RPS5362-I	HBL5362-I
	5362-I	
(15 amps) NEMA 5-15	RPS5262-I	HBL5262-I
	5262-I	

2. Duplex receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour model number PS5262LB (blue), 15 amps, 120 volts, or approved equal.
3. Single receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wire with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be thermoplastic. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts. For circuits consisting of one single receptacle only, ampere rating of receptacle shall be same as circuit breaker or fuse.

<u>NEMA #</u>	<u>Pass &amp; Seymour</u>	<u>Hubbell</u>
	<u>Leviton</u>	
(20 amps) NEMA 5-20R	5361-I	HBL5361-I
	5361-I	
(15 amps) NEMA 5-15R	5261-I	HBL5261-I
	5261-I	

4. 15 and 20 amps single receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour NEMA 5-20R model number 5361-BL (blue), and NEMA 5-15R model number 5261-BL (blue) respectively. Equal receptacles by other Owner approved manufactures are acceptable.
5. For kiln receptacles and range receptacles, provide 3-pole, 4-wire, grounding type, rated 50 amps at 125/250 volts NEMA 14-50R . Provide with 2-gang, stainless steel plates, SS 703, or equal.

<u>NEMA #</u>	<u>Pass &amp; Seymour</u>	<u>Hubbell</u>	<u>Leviton</u>
NEMA 14-50R	3894	HBL9450A	279
WALL PLATE	SS703	S703	84026

6. For dryer receptacles, provide 3-wire, non-grounding type, rated 30 amps at 125/250 volts, NEMA 10-30R, with 2-gang stainless steel plates.

<u>NEMA #</u>	<u>Pass &amp; Seymour</u>	<u>Hubbell</u>	<u>Leviton</u>
NEMA 10-30R	3860	HBL9350	5207
WALL PLATE	SS703	S703	84026

7. Provide specification grade ground-fault circuit interrupter (GFCI) type receptacles in accordance with 2003 UL standards. GFCI receptacles shall have a trip indication light. Receptacle terminal screws shall be back and side wire with internal screw pressure plates. Test and reset buttons shall match device body and shall be ivory. GFCI receptacles shall be manufactured in standard configuration for installation with stainless steel smooth plates. Exterior mounted receptacles shall be mounted inside weatherproof enclosure.

<u>NEMA #</u>	<u>Pass &amp; Seymour</u>	<u>Hubbell</u>	<u>Leviton</u>
NEMA 5-20R	2094-I	GFR5352-IA	8898-I
NEMA 5-15R	1594-I	GFR5252-IA	8598-I

8. Provide weatherproof receptacles, except where otherwise indicated or specified, consisting of GFCI receptacles, as specified herein, and metal plates with die-cast hinged lids and weatherproof mats; standard duplex cover

Pass & Seymour CA8GV, or equal. Standard GFCI cover Pass& Seymour CA26GV, or equal.

9. Provide tamper-resistant receptacles with thermoplastic dual mechanism shutter system to help prevent insertion of foreign objects. Receptacles shall have extra heavy-duty brass, one-piece mounting strap with integral ground. Receptacles shall be ivory color, impact resistant nylon face and back body. For tamper-resistant receptacles rated 20 amps/125 volts, provide NEMA 5-20R, ivory in color,. For tamper-resistant receptacles rated 15 amps/125 volts, provide NEMA 5-15R, ivory in color.

<u>NEMA #</u>	<u>Pass &amp; Seymour</u>	<u>Hubbell</u>	<u>Leviton</u>
(20 amps) NEMA 5-20R	TR63-I 8300SGI	HBL8300SHIA	
(15 amps) NEMA 5-15R	TR62-I 8200SGI	HBL8200SHIA	

10. Provide transient voltage surge suppression (TVSS) receptacles offering metal oxide varistors (MOVs) protecting normal and common modes, (L-N, L-G, N-G) with 500V suppressed voltage. TVSS devices shall offer 3-mode equal protection with 210 joules minimum per mode of energy absorption and 13,000 amp maximum surge capability. TVSS devices shall have 3 thermal fuses and two over-current protection fuses. TVSS devices shall have LED visual only surge status indicator to alert user to surge suppression circuit condition. Visual indicator will be illuminated (red) when power is on and surge suppression circuit is fully functional. Visual indicator will not be illuminated when power is off or unit experiences loss of surge suppression protection. Terminals shall be back and side wire including ground terminal. Color shall be blue.

<u>NEMA #</u>	<u>Pass &amp; Seymour</u>	<u>Hubbell</u>
(20 amps) NEMA 5-20R	<u>Leviton</u> 5352BLSP 5380B	HBL5360SA
(15 amps) NEMA 5-15R	5252BLSP 5280B	HBL5260SA

11. Receptacles within 6 feet of water fountains, counter tops, or any sources of water shall be GFCI type.

B. Switches:

1. Local Switches:

- a. Provide local switches, high strength thermoplastic toggle, specification grade, rated 20 amps at 120-277 volts AC only, with plaster ears, external screw pressure plate back and side wired, and standard size composition cups which fully enclose mechanism. Switches shall be approved for installation at currents up to full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80 percent of rating for motor loads. Switches shall have oversized silver alloy contacts for long life and better heat dissipation. Provide switches as single pole, double pole, 3-way, 4-way, non-lock type. Provide non-lock type switches with ivory handles;

	<u>Pass &amp; Seymour</u>	<u>Hubbell</u>
Single pole	PS20AC11	<u>Leviton</u> HBL12211

	1221-2I	
Double pole	PS20AC2I	HBL1222I
	1222-2I	
Three way	PS20AC3I	HBL1223I
	1223-2I	
Four way	PS20AC4I	HBL1224I
	1224-2I	

- b. Provide lock type switches, specification grade, 20 amp, 120-277 volts with metal or nylon key guides with on/off indication, and operable by same key. Keys for lock type switches as follows:

	<u>Pass &amp; Seymour</u>	<u>Hubbell</u> <u>Leviton</u>
Single pole	PS20AC1L 1221-2L	HBL1221L
Double pole	PS20AC2L 1222-2L	HBL1222L
Three way	PS20AC3L 1223-2L	HBL1223L
Four Way	PS20AC4L 1224-2L	HBL1224L

- c. Rotary lock switches shall incorporate a tumbler type lock to prevent unauthorized operation. Lock shall be tumbler type by Corbin, keyed to a HH41 key. Lock switch to be installed with pin tumblers facing downward. Key shall be removable in all positions. Each device shall be complete with 2 keys. Keys shall be delivered only to IOR. Switches shall be rated at 20 amps, 120-277 volt AC. Switch plates shall be of stainless steel, engraved with on and off positions indicated.

	<u>Pass &amp; Seymour</u>	<u>Hubbell</u> <u>Leviton</u>
Single pole	PS20AC1-KL 1221-2KL	HBL1221-RKL
Double pole	PS20AC2-KL 1222-2KL	HBL1222-RKL
Three way	PS20AC3-KL 1223-2KL	HBL1223-RKL
Four way	PS20AC4-KL 1224-2KL	HBL1224-RKL

- d. Pilot light switches shall be rated 20 amps and shall conform to specifications for local switches. Switches shall be furnished with red, Lexan handles that are lighted by long-lasting neon lamps. Pilot light shall light when load is on. Pilot light 120 volt switches

	<u>Pass &amp; Seymour</u>	<u>Hubbell</u> <u>Leviton</u>
Single pole	PS20AC1-RPL 1221-PL	HBL1221-PL
Double pole	PS20AC2-RPL 1222-PL	HBL1222-PL
Three way	PS20AC3-RPL 1223-PL	HBL1223-PL
	<u>Pass &amp; Seymour</u>	<u>Hubbell</u>

	<u>Leviton</u>
Single pole	PS20AC1-RPL7 1221-7P
	HBL1221-PL7

- e. Provide remote control switches for mechanically held contactors arranged for 3-wire control, tumbler type, momentary contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclose mechanism, and ivory handles.

<u>Pass &amp; Seymour</u>	<u>Hubbell</u>	<u>Leviton</u>
1251-I	HBL1557-I	1285-I

2. Time Switches and Photoelectric Controls Refer to Section 260923: .

- a. Provide time switches with a 7-day, solid-state, electronic type capable of fully automatic or manual operation and housed in a sheet steel enclosure unless built into a panel or switchboard. Contacts rated for 25 amps resistive or inductive, each pole 240 VAC; 5 amp tungsten or 470 VAC pilot duty, each pole 240 VAC. Time switches to contain a non-volatile clock and non-volatile memory with a built-in rechargeable power carry-over system. Provide a minimum of 15 on/off set points per week. Timing to be in one minute increments with a minimum on or off time of one minute. Time switch digital displays to indicate days of week, hours, and minutes. Display to contain a load status light to indicate when equipment is in operation. Time switches; EZ Controls Model EZ-701-1, single pole or Model EZ-701-2, double pole, or equal.
- b. For outdoor lighting control, provide time switches with digital and astronomic capabilities. Provide 365 days with holiday capabilities with 16 single dates and 5 holiday blocks of unlimited duration utilizing eighth and ninth day schedules. Provide 2 separately controllable relay closure output circuits. Each circuit to be single pole, double throw, with contacts rating of 10 amp resistive at 120/250V and 7.5 amp inductive at 120/250V. Provide 48 events per circuit per week; separate scheduling for each day of week. Provide selectable daylight saving or standard time, automatic leap year correction, and 72-hour memory backup with rechargeable battery. Time switch; Tork series DZS-200, or equal.
- c. Where more than 2 timed circuits are required, provide; Tork K series, or equal, digital, 4, 6 or 8 circuits, with following features:
- 1) Liquid crystal display panel.
  - 2) Holiday scheduling: Up to 40 dates may be assigned special holiday schedules, up to one year in advance.
  - 3) Automatically adjusts to and from daylight savings time and for leap year.
  - 4) Contact ratings: 10 amp at 240 VAC.
  - 5) Safety override switch for each circuit to either provide shut down of circuit or to override on.
  - 6) Selective review: All or part of schedule shall be displayed at touch of a key.
  - 7) Battery backup for 24 hours.
  - 8) Supply voltage: 120 V.
  - 9) 365-day advance scheduling.
- d. Photoelectric control: Photoelectric control rated 2,000 watts, 120V

with single pole, single throw, normally closed contact, enclosed in a die-cast aluminum gasketed enclosure with 1/2 inch conduit fitting,

## 2.3 IDENTIFICATION AND SIGNS

### A. Identification Plates:

1. Provide identification plates for the following unless otherwise specified, for switchboards, unit substations, motor control centers, control panels, push-button stations, time switches, contactors, motor starters, motor switches, panelboards, and terminal cabinets.
- 2.

Identification plates shall be of plastic stock and shall adequately describe function, voltage and phase of identified equipment. Where identification plates are detailed or described on Drawings, inscription and size of letters shall be as indicated. For lighting and power panels, identification plates shall indicate panel designation, voltage, and phase of panel. For terminal cabinets, identification plates shall indicate system contained in terminal cabinet.

3. Identification plates shall be black-and-white nameplate stock of bakelite with characters cut through black exposing white. Plates shall be furnished with beveled edges and shall be securely fastened in place with No. 4 Phillips-head, cadmium-plated steel, self-tapping screws. Characters shall be 3/16 inch high, unless otherwise indicated.

### B. Markings:

1. Install identification markings to surface-mounted starters, switches, disconnect switches, contactors, and other devices controlling motors and appliances. Provide abbreviations required along with an identifying number. Markings to be provided with locking type stencils using paint of a contrasting color. Figures shall be 3/8 inch high unless otherwise indicated. Dymo Industries Inc., self-sticking plastic labels, with embossed characters made with a typewriter may be installed instead of stencils and paint; p-touch self adhesive plastic, or Brother P-Touch self sticking laminated plastic labels may be installed.
2. High Voltage: High voltage switchboards, cabinets, boxes, and conduits exposed in accessible locations, including under buildings and in attics, are required to be marked "DANGER-HIGH VOLTAGE". Markings for switchboards shall consist of 18 gage steel, porcelain enamel sign of standard manufacture. Markings for boxes, cabinets, and conduits shall be by means of stenciling or printed self-adhesive markers, Westline Tel-A-Pipe, or equal. Provide letters of black on orange background and not less than 1-7/8 inches high. On conduit runs, install markings at intervals not exceeding 10 feet in any individual area. Markings shall be installed after other painting Work is complete.

### C. Warning Signs:

1. Provide a warning sign on outside of each door or gate to rooms or enclosures containing high voltage equipment. Signs required to read, "WARNING - HIGH VOLTAGE - KEEP OUT". Provide 2 inch high lettering.
2. Provide a warning sign on each high-voltage non-load break disconnect and fused cutout (not oil filled). Signs required to read, "DO NOT OPEN UNDER

- LOAD". Provide 2 inch high lettering.
3. Provide signs of standard manufacture, 18 gage steel, with porcelain enamel finish. Provide red lettering on a white background.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION AND SUPPORT OF BOXES**

- A. Install outlet boxes flush with finished surface of wall or ceiling. Install plumb and securely fastened to structure, independent of conduit. Except where otherwise indicated, provide factory-fabricated bar hangers to support outlet boxes. When installation is performed in fire rated walls, maintain the wall's rating integrity by means of approved fire stop methods.

Outlet boxes installed in suspended or furred ceilings with steel runner or furring channels shall be supported, except where otherwise indicated, by a Unistrut P-4000 channel spanning main ceiling runner channels. Each box shall be supported from its channel by a 3/8 inch 16 threaded steel rod with a Unistrut P-4008 nut and a Tomic No. 711-B Adapta-Stud. Rod shall be tightened to a jamb fit with channel and its nut. Box shall be locked to rod by means of a 1/2 inch locknut on stud and a 3/8 inch 16 hex nut locking stud to rod.

- B. Heights of outlets and equipment indicated on Drawings shall govern. In absence of such indications, following heights shall be maintained with heights measured to centerline unless otherwise noted:
  1. Install wall-mounted telephones, light switches, other switches, and fire alarm pull stations, 48 inches above finished floor. Refer to other Division 16 Sections.
  2. Install bell outlets in corridors 12 inches below ceiling.
  3. Install clocks, speakers, and bell outlets in classrooms and offices, 8 feet above finished floor. Unless otherwise indicated.
  4. Install fire alarm strobe lights 80 inches to bottom of light above finished floor.
  5. Install outside bells and yard light outlets 4 feet above second floor level for 2 or more story buildings, 12 inches below top plate level for one story buildings without covered porch or arcade, and 12 inches below covered porch and arcade ceilings.
  6. Install desk telephones, power receptacle outlets, and data outlets 15 inches above finished floor.
  7. Install panelboards and terminal cabinets 6 feet-6 inches from finish floor to top of cabinet.
  8. Install television outlets at a height corresponding to location of television monitor, or a minimum of 15 inches above finished floor. Refer to other Division 16 sections.

#### **3.2 COVER PLATES**

- A. Provide a plate on each switch, plug, pilot light, data, interphone, public telephone, and television outlet, and on existing and reset outlets where so indicated or required. Plates shall be of stainless steel unless otherwise specified.
- B. Flush wiring device and signal system outlets indicated to be blank covered, shall be covered with blank stainless steel plates. Flush lighting outlets to be blanked shall be



covered with Wiremold 5736 steel covers, or equal, painted to match surrounding finish. Provide stainless steel covers to blank indicated or required surface-mounted outlets.

- C. In the following cases, and at required locations. Switch and receptacle plates shall be engraved with the device(s), or fixtures being controlled, or as indicated:.
1. Three-gang and larger gang switches in locations other than classrooms.
  2. Lock switches.
  3. Pilot switches.
  4. Switches so located that operator cannot see fixtures, or items of equipment controlled while his hand is on the switch.
  5. Switches not in same room with fixtures or items of unit heaters, air curtains, fly fans, etc.
  6. Receptacles operating at other than 120 V shall be labeled with the operating voltage.
  7. Switches operating on 277 V shall be labeled with the operating voltage.
  8. Where indicated on Drawings.
- D. Designations shall be as indicated on Drawings or as specified by Architect,

### 3.3 IDENTIFICATION OF CIRCUITS AND EQUIPMENT

- A. Provide descriptive nameplates or tags permanently attached to switchboards, motor control centers, transformers, panelboards, circuit breakers, disconnect switches, starters, pushbutton control stations and other apparatus installed for operation or control of circuits, appliances, fire alarm control panel(s), fire alarm annunciator(s), power supplies, terminal cabinets, energy management control units, and Information technology system backbone and distribution equipment points. .
- B. Provide nameplates of engraved laminated plastic, or etched metal. Submit Shop Drawings denoting dimensions and format to Architect before installation. Fasten to equipment with escutcheon pins, rivets, self-tapping screws, or machine screws. Self-adhering or adhesive backed nameplates are not permitted.
- C. Fasten tags to feeder wiring in conduits at every point where runs are broken or terminated, including pull wires in empty conduits. Indicate circuit, phase, and function. Tag branch circuits in panel boards and motor control centers. Tags may be manufactured of pressure-sensitive plastic or embossed self-attached stainless steel or brass ribbon.
- D. Provide circuit identification cards and cardholders in all panel boards. Cardholders shall consist of metal frame retaining a clear plastic cover permanently attached to inside of panel door. List of circuits shall be typewritten on a card. Circuit description shall include name or number of circuit, area and connected load.
- E. Junction and pull boxes shall have covers stenciled with box number when indicated on Drawings, or circuit numbers according to panel schedules. Data shall be lettered in a conspicuous manner with a color contrasting with finish.
- F. Name shall be correctly engraved, with a legend indicating function or areas, when required by codes or indicated on Drawings.

3.4 PROTECTION

- A. Protect Work of this section until Substantial Completion.

3.5 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

**SECTION 26 05 04**  
**SERVICE ENTRANCE**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes: Provide all underground lighting and power service conduits from utility company service pole or other service point to Project service equipment as indicated on Drawings and as specified.
- C. Related Sections:
  - 1. Cast-In-Place Concrete – 03 30 00.

1.2 DESIGN REQUIREMENTS

- A. Comply with requirements of utility company having jurisdiction. Where required and indicated on Drawings, install transformer vault, outdoor transformer enclosure, pad and slab box, manholes or other equipment pertaining to service.
- B. Consult utility company to determine exact location of serving point or service poles, quadrants on poles for service risers and work and material. Service installation shall be complete and ready for cable installation. Service cable will be provided by utility company and will be paid for by the Owner.
- C. Interrupting capacity of main circuit breaker and distribution circuit breakers shall be equal to or greater than available short-circuit current at point as obtained by utility company or computed by the Architect. Selective coordination between main and feeder circuit breakers is required.

**PART 2 - PRODUCTS**

2.01 MATERIALS

- A. Transformer Pads: Concrete transformer pads shall be provided as indicated on Drawings and shall meet requirements of serving electric utility company.
- B. Service Conduits: As described under Section 16130: Raceways, Fittings and Supports. For utility portion of wiring and conduit runs, comply with utility company requirements.

**PART 3 - EXECUTION**

3.1 INSTALLATION

- A. Service conduits shall terminate at service poles or other service point, as indicated on Drawings and shall extend underground to main service terminating pull section as indicated. Bends in conduits shall be long radius type and sweeps shall have a radius of not less than 10 times conduit trade size. Underground conduits shall be encased in concrete 3 inches thick on all sides with multiple conduits spaced not less than 1-1/2

inches apart, or use utility company recommended spacing, whichever is greater. Provide support for conduits to prevent floating when encased.

B. Service Cables:

1. Overhead: Shall be connected to metering compartment of switchboards.
2. Underground: Shall be in service terminating pull section as required and directed by utility company.

3.02 CONDUITS CROSSING PUBLIC DEDICATED PROPERTY

- A. Where service or other conduits cross a street, alley, highway, or other public dedicated property, provide all necessary arrangements to open and close public property and pay costs in connection with required licenses, permits, fees and deposits. Conduits shall be installed in a manner required by authorities having jurisdiction.

3.03 STRUCTURAL CONDITIONS

- A. Where conduits are to pass through or interfere with structural members, or where notching, boring or cutting of structure is necessary, or where special openings are required through walls, floors, footings, or other building elements to accommodate electrical Work, such Work shall be performed as required by the Architect and DSA.
- B. Placement of conduits in concrete slabs and structural members shall comply with requirements of applicable section of CCR, Title 24, Public Works and shall be as required by Architect and DSA.
- C. Where a concrete encasement for underground conduits abuts a foundation wall or underground structure which conduits enter, encasement shall be maintained in position in relation to structure as indicated on Drawings, or rest on a haunch integral with wall or structure, or shall extend down to footing projection, or shall be doweled into structure. Underground structures shall include manholes, pull boxes, vaults, and buildings.
- D. Cutting and patching of rough and finish Work shall be performed as required for installation of Work under this section. Patching shall be of same materials, workmanship and finish and shall accurately match surrounding Work.

3.04 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

## SECTION 26 05 19

### LOW-VOLTAGE WIRES (600 VOLT AC)

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes: Low-voltage wire, splices, terminations and installation.

##### 1.02 SUBMITTALS

- A. Provide in accordance with Division 01.

#### PART 2 - PRODUCTS

##### 2.1 WIRES

- A. Wires shall be single conductor type THHN or THWN-2 insulated with polyvinyl chloride and covered with a protective sheath of nylon, rated at 600 volts. Wires may be operated at 90 degrees C. maximum continuous conductor temperature in dry locations, and 75 degrees C. in wet locations and shall be listed by UL Standard 83 for thermoplastic insulated wires, listed by Underwriter's Laboratories (UL) for installation in accordance with Article 310 of the California Electrical Code (CEC). Conductors shall be solid copper for 12 AWG and smaller conductors, and stranded copper for 10 AWG and larger conductors. Conductors shall be insulated with PVC and sheathed with nylon. Wires shall be identified by surface markings indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Indentations for lettering is not permitted. Wires shall be tested in accordance with the requirements of UL standard for types THWN, or THHN.
- B. Conductors shall be solid Class B or stranded Class C, annealed uncoated copper in accordance with UL standards, or another Nationally Recognized Testing Laboratory (NRTL).

##### 2.2 STANDARDS

- A. THWN-2/THHN wires shall comply with the following standards:
  - 1. UL 83 for thermoplastic insulated wires.
  - 2. UL 1063 for machine tool wires and cables.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed and walls are completed.
- B. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. Pulling of 2 AWG or larger conductors shall be performed with a cable pull machine. Any runs shorter than 50 feet are exempt. When pulling conductors, do not exceed manufacturer's recommended values
- C. The IOR will observe installation of feeder cables. Notify the IOR not less than 2 working days in advance of the proposed time of feeder installation.
- D. At outlets for light, power, and signal equipment, pigtail splices with 8-inch circuit conductor leads for connection to fixtures, equipment, and devices.
- E. Pressure cable connectors, pre-insulated Scotchlok, 3M, or equal, Y, R or B spring-loaded twist-on type, may be furnished in splicing number 8 AWG or smaller wires for wiring systems; except public address and telephone systems.
- F. All Joints, splices, taps, and connections to switchboard neutral, bonding or grounding conductors, conductors to ground busses, and transformer connections for wires 6 gauge and larger shall be performed with high-pressure cable connectors approved for installation with copper conductors. Connectors shall be insulated with heavy wall heat shrink WCSM, or cold-applied roll-on sleeve RVS. Insulation level shall be a minimum of 600V and joints, splices, and taps shall be qualified to ANSI C 119.2, UL, NRTL, or equal listed mechanical pressure connections.
- G. Connections to any bussing and high-press cable connectors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade 5 machine screws secured with constant pressure-type locking devices.
- H. Connection of any bonding or grounding conductors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade 5 machine screws secured with constant pressure-type locking devices.
- I. Wire switchboards, panel cabinets, pull boxes, and other cabinets except public address, shall be neatly grouped and tied in bundles with nylon ties at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals. If bundles are longer than 24 inches, a maximum of 9 current carrying conductors may be bundled together.
- J. Install conductor lengths with a minimum length within the wiring space. Conductors must be long enough to reach the terminal location in a manner that avoids strain on

the connecting lug.

- K. Maintain the conductor required bending radius.

Neutral conductors larger than 6 gauge, which are not color identified throughout their entire length, shall be taped, painted white or natural gray, or taped white where they appear in switchboards, cabinet, gutters or pull boxes. Neutral conductors 6 gauge and smaller shall be white color identified throughout their entire length.

- L. Fire alarm and clock wiring shall be continuous from terminal cabinets or from equipment to each device. Splices are not permitted between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at terminal blocks or devices only.

- M. Wiring systems shall be free from short circuits and grounds, other than required grounds. Provide the services of an approved independent testing laboratory to test feeder insulation resistance. The tests to be performed are as follows:

1. With a megger insulation tester, perform the time-resistance method to test feeders and branch circuit wires. Tests must be conducted with wire disconnected at each end in order to test the wire itself. A second test must be conducted with the wire connected at each end and the circuit breakers or switches in the closed positions.
2. Tests shall be performed in presence of the IOR.
3. Insulation resistance shall not be less than 100 mega-ohms.

3.2 COLOR CODES

- A. General Wiring:

1. Color code conductor insulation as follows:

SYSTEM VOLTAGE		
Conductor	208Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White or Gray	White with colored stripe

Neutrals shall be colored-distinguished if circuits of two voltage systems are used in the same raceway.

2. For phase and neutral conductors 6 gauge or larger, permanent plastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

- B. Signal Systems: Wires for signal systems shall be color-coded and installed under observation of the IOR. Except where otherwise specified, *for conflicts coordinate with IOR*. Color-coding shall be as follows:

<u>SYSTEM</u>	<u>COLOR CODE</u>
Clocks	Pink, Gray and Orange

Program Bells (some existing)	White (Common)Black
elementary schools)	
Initiating Devices (Non-Addressable)	Red (+) and Black (-)
Program Bells (some existing secondary schools)	White (120 volt, common) Black (C.R. program) Blue (Shop program) Brown (Gym program) Yellow (Auditorium fire alarm)
Fire Alarm Horns	Pink (+) and Gray (-)
Fire Alarm Strobes	Orange (+) and Blue (-)
Un-Interruptible 24 Volt Power (Annunciator, Water Flow, and Audible Device)	Yellow (+) and White (-) Note: A single white wire may be common to both
Interruptible 24 Volt Power (4 wire smoke detectors, duct detectors)	Brown (+) and White (-) Note: A single white wire may be common to both
Switch-Leg Sprinkler Bell (Between water flow and audible device)	Violet (+) and White (-)
Door Holding Magnets (Non Power Limited)	Black (+) and White (-)

3.3 FEEDER IDENTIFICATION

- A. Feeder wires and cables shall be identified at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers, which provide terminal strain relief. Markers shall be Brady Perma-Sleeve, or equal. Identification in other areas shall be by means of wrap-around tape markers Brady Perma-Code or equal. Markers shall include feeder designation, size, and description.

3.4 TAPE AND SPLICE KITS

- A. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with insulation equivalent to that provided on conductors. Free ends of conductors connected to energized sources shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications.

3.5 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.6 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION



SECTION 26 05 26  
GROUNDING AND BONDING

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes: Provide and install grounding system as indicated or required.
- C. Related Sections:
  - 1. Refer to related sections for their system grounding requirements.
  - 2. Section 26 05 00: Basic Electrical Requirements.
  - 3. Division 25: Low Voltage Systems

1.2 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. IEEE 142 Green Book.
  - 2. Underwriter's Laboratories (UL).
  - 3. California Electrical Code.
  - 4. Building Industry Consultant Services International (BICSI) (Signal).
  - 5. EIA/TIA (Signal and power).
  - 6. Nationally Recognized Testing Laboratory (NRTL) or equal.

1.3 SYSTEM DESCRIPTION

- A. Metallic objects on the Project site that enclose electrical conductors, or that are likely to be energized by electrical currents, shall be effectively grounded.
- B. Metal equipment parts, such as enclosures, raceways, and equipment grounding conductors, and earth grounding electrodes shall be solidly joined together into a continuous electrically conductive system.
- C. Metallic systems shall be effectively bonded to the main grounding electrode system.
- D. A separately derived AC source shall be grounded to the equipment grounding conductor, and to separate "made" electrode of building grounding electrode system.
- E. Electrical continuity to ground metal raceways and enclosures, isolated from equipment ground by installation of non-metallic conduit or fittings, shall be provided by a green insulated grounding conductor of required size within each raceway connected to isolated metallic raceways, or enclosures at each end. Each flexible conduit over 6 feet in length shall be provided with a green insulated grounding conductor of required size.

- F. Cold water, or other utility piping systems, shall not be utilized as grounding electrodes *if the installation is* non-metallic pipe in such installations. Grounding electrodes shall be “made” electrodes specified as follows:
1. A dedicated “made” electrode, fabricated of at least 20 feet of galvanized 1/2 inch diameter rebar encased by at least 2 inches of concrete, and placed next to the bottom of a concrete foundation, or footing in direct contact with earth A welded extended portion shall surface at the location of the common grounding electrode bus bar and be extended by a 3/0 CAD welded bare copper cable, or be CAD welded directly to the bus. The CAD weld shall be at least 4 inches above finished floor in a dry location. The main grounding electrode and associated grounding conductors shall be in an enclosure and in conduit.
  2. Grounding electrodes as specified hereafter in this section.
  3. Concrete enclosed electrode, fabricated of at least 20 feet of No. 2 AWG, minimum size, bare copper conductor, encased by at least 2 inches of concrete, located within or near bottom of a concrete foundation, or footing, which is in direct contact with earth. Footing rebar shall be connected to copper wire with approved connectors. An external electrode, as specified hereafter or as required by the CEC, shall be installed and connected to foundation or footing rebar.
  4. *Install a Uffer ground in addition to the ground electrode described above. The ufer ground, grounding electrode shall consist of 40-foot length of bare #250MCM copper bare conductor extend its full length below ground level and embedded along the bottom of the concrete pad which is in direct contact with the concrete housekeeping pad. A loop at the approximate center of this grounding electrode to the main ground electrode bus, shall connect the ground electrode by exothermic welding to the main service ground electrode bus as specified hereafter or as required by the CEC..*
- G. Non-current carrying metal parts of high-voltage equipment enclosures, signal and power conduits, switchboard and panelboard enclosures, motor frames, equipment cabinets, and metal frames of buildings shall be permanently and effectively grounded. Provide a CEC sized grounding conductor in every raceway.
- H. Metallic or semi-conducting shields and lead sheaths of cables operating at high voltage, shall be permanently and effectively grounded at each splice and termination.
- I. Neutral of service conductors shall be grounded as follows:
1. Neutral shall be grounded at only one point within the Project site for that particular service. Preferable location of grounding point shall be at the service switchboard, or main switch.
  2. Equipment and conduit grounding conductors shall be bonded to that grounding point.
  3. If other buildings or structures on the Project site are served from a switchboard or panelboard in another building, power supply is classified as a feeder and not as a service.
  4. Equipment grounding conductor is installed from switchboard to each individual building. At building, grounding conductor is bonded with power equipment enclosures, metal frames of building, etc., to “made” electrode for that building.
  5. Feeder neutrals shall be bonded at service entrance point only, neutrals of separately derived systems shall be bonded at the source only.
- J. If there is a distribution transformer at a building the secondary neutral conductor shall be grounded to “made” electrode serving the building.

- K. Within every building, the main switchboard or panelboard, shall be bonded to the cold water line. Metallic piping systems such as gas, fire sprinkler, or other systems shall be bonded to the cold water line.

#### 1.4 SUBMITTALS

- A. Provide in accordance with Division 01.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- A. Furnished yard boxes shall be precast concrete and shall be approximately 14 inches wide by 19 inches long by 12 inches deep or larger, if necessary to obtain required clearances. Boxes shall be furnished with bolt-down, checkered, cast iron covers and cast iron frames cast into boxes. Yard boxes shall be Brooks 36, or equal.
- B. "Made" electrodes shall be copper-clad steel ground rods, minimum 3/4 inch diameter by 10 feet long.

### **PART 3 - EXECUTION**

#### 3.01 INSTALLATION

- A. Grounding electrodes shall be installed in the nearest suitable planting area, where not otherwise indicated on Drawings, and each electrode shall terminate within a concrete yard box installed flush with finish grade. In planting areas, finish elevation of concrete yard boxes shall be 2 inches above planting surfaces.
- B. If concrete enclosed electrode is provided, grounding wire shall be terminated to a suitable copper plate with grounding lugs and must be enclosed in a raceway or box..
- C. Grounding rods shall be driven to a depth of not less than 8 feet. Permanent ground enhancement material, as manufactured by Erico Electrical Products, or equal, shall be installed at each ground rod to improve grounding effectiveness. Install in accordance with manufacture's installation instructions.
- D. Grounding electrodes shall provide a resistance to ground of not more than 25 ohms.
- E. When installing grounding rods, if resistance to ground exceeds 25 ohms, 2 or more rods connected in parallel, or coupled together shall be provided to meet grounding resistance requirements.
- F. Ground rods shall be separated from one another by not less than 10 feet.
- G. Parallel grounding rods shall be connected together with recognized fittings and grounding conductors in galvanized rigid steel conduit, buried not less than 12 inches below finish grade.

3.02 TESTING

- A. Provide the services of an approved independent testing laboratory to test grounding resistance of “made” electrodes, ground rods, bonding of building steel, water pipes, gas pipes and other utility piping. Tests shall be performed as follows:
  - 1. Visually and mechanically examine ground system connections for completeness and adequacy.
  - 2. Perform fall of potential tests on each ground rod or ground electrode where suitable locations are available per IEEE Standard No. 81, Section 8.2.1.2. Where suitable locations are not available, measurements will be referenced to a known dead earth or reference ground.
  - 3. Perform the two point method test per IEEE No. 81, Section 8.2.1.1 to determine ground resistance between ground rod and building steel, and utility piping - such as water, gas and panelboard grounds. Metal railings at building entrances and at handicapped ramps shall also be tested.
  - 4. Test shall be performed in the presence of the IOR.
- B. Submit 3 copies of test results to the Architect. Test results shall be submitted on an official form from the independent testing laboratory recording Project location, test engineer, test conditions, test equipment data, ground system layout or diagram, and final test results.

3.3 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.4 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

**SECTION 26 05 33**  
**RACEWAYS, FITTINGS AND SUPPORTS**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
  - 1. Raceways and wire ways
  - 2. Conduit installation.
  - 3. Underground requirements.
- C. Related Sections:
  - 1. Section 26 05 00: Basic Electrical Requirements.
  - 2. Section 26 05 01: Basic Electrical Materials and Methods
  - 3. Division 25: Low Voltage Systems
- D. Applicable Standards and Codes
  - 1. EIA/TIA 569 Standards.
  - 2. National American Standards Institute (ANSI)
  - 3. National Electrical Manufacturer's Association (NEMA)
  - 4. Nationally Recognized Testing Laboratory (NRTL)
  - 5. California Electrical Code (CEC)
  - 6. Uniform Building Code (UBC)
  - 7. Underwriters Laboratory (UL)

1.2 SUBMITTALS

- A. Materials List: Provide in accordance with Division 01.

**PART 2 - PRODUCTS**

2.1 RACEWAYS

- A. Conduit Materials:
  - 1. Metallic conduit, and tubing shall be manufactured under the supervision of an UL, or another NRTL factory inspection and label service program. Each 10-foot length of conduit and tubing shall bear the UL or another NRTL label and manufacturer's name.
  - 2. Rigid metallic conduit shall be rigid steel, heavy wall, mild steel, zinc-coated, with an inside and outside protective coating manufactured in accordance with ANSI C 80.1. Couplings, elbows, bends, condulets, bushings and other fittings shall be the same materials and finish as the rigid metallic conduit. Fittings, connectors, and couplings shall be threaded type, manufactured in accordance with ANSI C 80.1 and UL 6.
  - 3. Electrical metallic tubing shall be steel tubing, zinc-coated with a protective enamel coating inside, manufactured in accordance with NEMA C 80.3. Fittings, couplings, and connectors shall be gland compression type, set screw couplings and connectors not permitted. All parts shall be manufactured in accordance with NEMA C80.3 and UL 6A Electrical metallic tubing is designated hereinafter as EMT. Steel and rain tight fittings shall be approved and listed for the intended application.

4. Flexible steel conduit shall be of flexible interlocking strip construction with continuous zinc coating on strips, manufactured in accordance with UL 1..
    - a. Connectors and couplings shall be required fittings of the type, which threads into convolutions of flexible conduit.
  5. Liquid-tight flexible metal conduit shall be galvanized heavy wall, flexible locked steel strip construction, UV rated, with smooth moisture and oil-proof, abrasion-resistant, extruded plastic jacket. Connectors shall be as required for installation with liquid-tight flexible conduit and shall be installed to provide a liquid-tight connection.
  6. Non-metallic conduit shall be rigid PVC electrical conduit extruded to schedule 40 dimensions of Type II. Grade 1 high impact, polyvinyl chloride, sweeps, couplings, reducers and terminating fittings shall be listed under the UL, or another NRTL, and shall bear the manufacturer's listed marking.
  7. Multi-cell raceway shall be 4 inch PVC, Type 40, UL or another NRTL listed for underground use with optical fiber and signal system cables. Raceway shall be furnished with 3-1/2 inch factory installed inner ducts with required internal spacers, and required couplers, sweeps, and end bells. Multicell raceway shall be Carlon Multigard, or District approved equal.
  8. Metal Clad (MC) cable system is not allowed.
- B. Sleeves for Conduits: Sleeves shall be adjustable type, of 26 gage galvanized iron, Adjust-to Crete Co. Adjust-to-Crete, or Jet Line Products Inc. Jet-Line, or equal.
- C. Where conduit enters a building through a concrete foundation below grade, or ground water level, or where it is necessary to seal around a conduit where it passes through a concrete floor or wall, provide O-Z/Gedney Type FSK Thru Wall and Floor Seal, or equal.
- D. Expansion Joints-Seismic Separations between building(s) and other locations as indicated on drawings:
1. Provide Thomas & Betts XJG-TB, O-Z/Gedney. type AX with bonding strap and clamps, or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z/Gedney type EX, or equal. Provide O-Z/Gedney type AXDX, or equal combination deflection/expansion fittings at all seismic separations. Provide manufacture's internal and external bonding jumpers at all locations. Liquid-tight metal conduit or flexible metal conduit shall not be approved at expansion joints, separations between buildings or seismic separations.
  2. Provide expansion fittings at intervals not exceeding 100 feet in conduits exposed to direct sunlight. Fittings may be installed in the conduit run or where conduit attaches to junction or pull boxes. OZ/Gedney type AX, TX or EXE series, or equivalent by Thomas and Betts or approved equal.
- E. Conduit Seal Fittings:
1. Provide conduit seal fittings where indicated on the Drawings. Conduit seals shall be of rigid galvanized steel. Seals in horizontal conduit installations shall be Appleton Type ESU, Crouse Hinds Type EYS, or equal. Seals in vertical conduit installations shall be Appleton Type SF, Crouse Hinds Type EYD, or equal, with continuous drain. When installing conduit seals make provision for percent fill space reduction in accordance with CEC.
  2. Install sealing compound after wire has been installed. Ensure drain is not blocked in vertical seals when installing compound. Where conduit seals are installed in hazardous area applications, there shall be no conduit coupling, fitting, etc., between seal and boundary of hazardous area.

F. Surface Steel Raceway:

1. The surface steel raceway system for branch circuit wiring, data network, voice, video, and other low voltage wiring shall be as manufactured by the Wiremold Company, Hubbell, or Mono-Systems, Inc. or equal. The raceway system may be supplied pre-wired in accordance with all sections of these specifications and requirements herein, and shall be UL or another NRTL listed. Computer data installation shall be as required by other sections of this Division.
  - a. If furnished pre-wired, the system must be listed in accordance with UL or another NRTL for "Multiple Outlet Assemblies" and so labeled on interior of the assembly. The pre-wired installation must contain no extra wire splices in the raceway as compared to a contractor assembled installation assembled from components. The pre-wired steel raceway shall be Hi-Pot tested at the factory to prevent any potential bare wire or short circuit defects.
2. The raceway base, cover, and device bracket shall be manufactured of steel and finished in ivory, gray enamel or custom colors suitable for field painting to match adjacent finishes.
3. The raceway shall be a 2-piece design with a metal base and snap-on metal cover, except for the Wiremold V700 system, Hubbell V750 series and Mono-Systems Inc. S145-700 series. Which shall be a one-piece design. The base and cover sections shall be a minimum of 0.040 inch wall thickness. The base section shall be available in 10-foot lengths. A hand-operated cutting tool shall be available for the base and cover to ensure clean, square cuts. Wiremold V500, Hubbell V500, and Mono Systems inc. SM500 series are not permitted.
4. A full complement of fittings shall be furnished, including but not limited to, flat internal and external elbows, tees, entrance fittings, wire clips, cover clips, couplings, support clips, C-hangers and end caps. The fitting color shall match the raceway color. Fittings shall be supplied with a base where indicated and/or required. A take-off fitting shall be furnished as required to adapt to existing flush wall boxes.
5. Device brackets shall be furnished for mounting single or 2-gang devices within the raceway. Devices shall be provided with the ability of mounting flush or in conjunction with standard steel, stainless steel, or manufacturer's metal faceplates.
6. The raceway shall be furnished with a complete line of connectivity outlets and modular inserts for unshielded twisted pair including category 5, fiber-optic, coaxial, and other cabling types with face plates and bezels to facilitate installation. Computer data installation shall be as required by other sections of this Division, and Division 25.
7. Raceway shall be furnished with corner elbows and tee fittings to maintain a cable bend radius which meets the requirements of fiber-optic and copper cables under EIA/TIA 569 for communications pathways.

G. Factory Pre-Wired Surface Metal Raceway:

1. Furnish and install pre-wired surface metal raceways as indicated on Drawings and as specified.
2. Metal Raceway shall be galvanized steel Wiremold V4000, Hubbell 4000 series, or Mono-Systems Inc. SMS-4000 series complete with raceway base, cover, fittings, receptacles and mounting plates required for a complete

assembly. Raceway shall have two wiring compartments with integral dividing barrier for isolating the wiring compartments.

3. Pre-wired assembly shall be UL, or another NRTL listed as a multi-outlet assembly and surface raceway as labeled on interior of assembly.
4. Wiring devices and other components shall be factory installed, electrically wired and covers labeled as indicated on drawings. Each receptacle shall be identified with panelboard and circuit number from which it was fed. Grounding shall be maintained by means of factory installed grounding conductors.
5. Where shown on Drawings, Raceway covers shall have provisions for mounting computer data outlets.
6. Complete assembly is to consist of required fittings such as elbows, slide couplings for joining raceway sections, blank end caps and flat tees.
7. Prewired assembly must contain no wire splices.
8. Receptacles and wiring shall be as indicated on drawings and as specified.
9. Where raceway is used for power and computer data outlets, installation of data outlets shall be as required by other sections of this specification.
10. Prior and during installation, verify and comply with manufacturer's installation instructions.
11. Entire assembly shall be tested for shorts, opens, ground faults, and wire insulation at factory and certified. Raceways shall be electrically continuous and bonded in accordance with California Electrical Code.
12. Submit shop drawings for approval showing the complete layout of all components of each raceway, raceway lengths, each component description, location and circuit identification.
13. All wiring devices shall be removable without requiring disassembly of wireway.
14. Standard non OEM wiring devices shall be used as specified in District's specifications.

- H. Wireways shall be 16 gage galvanized steel enclosed hinge/screw wiring troughs, surface metal raceway, wireway, and auxiliary gutter designed to enclose electrical wiring. Wireway fittings shall be furnished with removable covers and sides to permit complete installation of conductors throughout the entire wireway run. Cover shall be furnished with keyhole slots to accept captive screws locking the cover securely closed. Wireways shall be UL or another NRTL listed, and shall be Square D Type LDG NEMA-1 enclosure for interior applications, or Type RD NEMA-3R enclosure for exterior applications, or equal by Cooper B-line, Hoffman, Wire Guard, or Circle AW.
- I. Penetration in Fire-Rated Structures: Provide 3M, or equal, caulk and fire barriers for installing fire-rated seals around penetrations through floors, walls, and elevator shafts. Fire stop system must be UL, or another NRTL listed, and classified for through-penetration applications of metallic conduits and busways.
- J. Pull Wires: Install 1/8 inch polypropylene cords in empty or spare conduits.

### **PART 3 - EXECUTION**

#### **3.1 CONDUIT INSTALLATION**

- A. General Requirements:
  1. Provide complete and continuous systems of rigid metallic conduit, outlet boxes, junction boxes, fittings and cabinets for systems of electrical wiring including lighting, power, and signal systems, except as otherwise specified.



2. EMT may be installed in interior concealed applications and in areas approved by owner. EMT shall not be installed in concrete, directly buried underground, outdoors, in boiler rooms, elevator pits, or where subject to damage.
3. Within buildings, flexible steel conduit may be installed instead of rigid steel conduit where permitted by code. Flexible steel conduit shall not be installed for conduit installations longer than 50 feet (inclusive of fittings and boxes), in concealed ceilings or walls, and where conduit size is 1-1/2 inches or greater.
4. Liquid-tight flexible steel conduit shall only be installed, except where otherwise specified, for final connection of motor terminal boxes, shop equipment, cafeteria equipment, HVAC equipment and other equipment, or for frequent interchange, and shall be of sufficient length, not exceeding 36 inches, to permit full travel or adjustment of motor on its base. Liquid-tight flexible conduit shall not be used for equipment not requiring adjustment or frequent interchange.
5. Connectors for flexible metal conduit shall be made of steel, and of the types which threads into convolutions of conduit. Connectors for watertight flexible metal conduit shall be as required for installation and shall be installed to provide a watertight connection.
6. Exposed conduit shall be installed vertically and horizontally following the general configuration of the equipment, using cast threaded hub conduit fittings where required and shall be clamped to equipment with suitable iron brackets and one hole pipe strap.
7. If connection is from a flush wall-mounted junction box, install an approved extension box.
8. Underground feeder distribution conduits for systems may be non-metallic conduit instead of rigid conduit except where otherwise specified or indicated.
9. Conduit shall be concealed unless otherwise indicated. Conduits exposed to view, except those in attic spaces and under buildings, shall be installed parallel or at right angles to structural members, walls, or lines of building. Conduits shall be installed to clear access openings.
10. Bends or offsets will not be permitted unless absolutely necessary. Radius of each conduit bend or offset shall be as required by ordinance. Bends and offsets shall be performed with standard industry tools and equipment or may be factory fabricated bends or elbows complying with requirements for radius of bend specified. Heating of metallic conduit to facilitate bending is not permitted. Public telephone conduit bends and offsets shall be provided with a radius which is not less than 10 times trade size of conduit unless otherwise permitted. Refer to underground installation, specified in this section, for radius of bends and offsets required for underground installations.
11. Running threads are not permitted. Provide conduit unions where union joints are necessary. Conduit shall be maintained at least 6 inches from covering of hot water and steam pipes and 18 inches from flues and breechings. Open ends of conduits shall be sealed with permitted conduit seals during construction of buildings and during installation of underground systems.
12. Expansion Joints/Seismic Separations/Separations between buildings/Locations Indicated: Provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type AX with bonding strap and clamps. At exterior locations, provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type EX, or equal. Provide O-Z Electrical Mfg. Co. Type AXDX, or equal Combination Deflection/Expansion Fittings at all seismic separations. Provide

manufactures internal and external Bonding Jumpers at all locations. Liquid-tight flexible conduit shall not be approved at expansion joints or seismic separations.

13. Where conduits are terminated in groups at panelboards, switchboards, and signal cabinets, etc., provide templates or spacers to fasten conduits in proper position and to preserve alignment. Conduits terminating at signal cabinets shall only enter cabinets in the following locations:
  - a. Conduits entering top, side, and bottom of cabinets shall be aligned in a single row, centered 2 inches from rear of cabinet.
  - b. Conduits entering back of cabinet shall be aligned in a single row centered 2 inches from top of cabinet.
  - c. Conduits shall not be spaced closer than 3 inches on centers.
14. Conduits above metal lath ceilings shall be rigidly suspended with pipe hangers or pipe racks or shall be secured to superstructure with factory fabricated pipe straps. Conduits in metal lath or steel stud partitions shall be tied to furring channels or studs. In ceiling spaces and in partitions, tie wires shall be spaced not more than 5 feet apart, shall fasten conduit tight against channels and studs at point of tie and shall not support any of conduit weight. Tie wire shall be 16 gage galvanized double annealed steel.
15. Where auxiliary supports, saddles, brackets, etc., are required to meet special conditions, they shall be fastened rigid and secure before conduit is attached.
16. Conduit in ceiling spaces, stud walls, and under floors, shall be supported with factory fabricated pipe straps or shall be suspended with pipe hangers or pipe racks. Pipe straps shall be attached to and shall fasten conduit tight at point of support against ceiling and floor joists, rafters, and wall studs, or 2-inch x 4-inch headers fitted between joists or wall studs.
17. Conduits installed on exposed steel trusses and rafters shall be fastened with factory fabricated conduit straps or clamps, which shall fasten conduit tight against supporting member at point of support.
18. Conduits installed under buildings shall be strapped with factory fabricated conduit straps to underside of concrete floor or joists, or wood floor joists, or shall be suspended with pipe hangers or pipe racks. Conduits under building are not permitted to be placed directly on grade; they shall be suspended from building or shall be buried below surface or ground. 1-1/4 inch and larger conduits under buildings shall be installed with conduit hangers or racks.
19. Pipe hangers for individual conduits shall be factory fabricated. Steel rods shall be 3/8 inch for 2-inch conduit hangers and smaller and shall be 1/2 inch for 2-1/2 inch conduit hangers and larger.
20. Pipe racks for groups of parallel conduits and for supporting total weights not exceeding 500 pounds shall be trapeze type and shall consist of a cross channel, Steel City Kindorf B-900, Unistrut P-1000, or equal, suspended with a 3/8 inch minimum diameter steel rod at each end. Rods shall be fastened with nuts, top and bottom to cross-channel and with square washers on top of channel. Conduits shall be clamped to top for cross-channel with conduit clamps, Steel City Kindorf C-105 or Unistrut P-1111 through P-1124. Conduits shall not be stacked one on top of another, but a maximum of 2 tiers may be on same rack providing an additional cross-channel is installed. Where a pipe rack is to be longer than 24 inches, or if the supported weight exceeds 500 pounds, submit Shop Drawings of installation to the Architect for review.

21. Conduits suspended on rods more than 2 feet long shall be rigidly braced to prevent horizontal motion or swaying. Installation shall meet zone 4 seismic requirements.
22. Factory fabricated pipe straps shall be one or 2-hole formed galvanized clamps, heavy-duty type, except where otherwise specified.
23. Hangers, straps, rods, or pipe supports under concrete shall be attached to inserts set at time concrete is placed, or with approved concrete anchors. Under wood, install bolts, lag bolts, or lag screws; under steel joists or trusses, install beam clamps. Contractor shall submit size of anchors, bolts, screws, and installation method to Architect for approval prior to start of any work.
24. Conduits shall be supported at intervals required by code, but not to exceed 10 feet. One inch and smaller exposed conduits shall be fastened with one-hole malleable iron straps. Perforated straps and plumber's tape is not permitted for the support of conduits.
25. Conduits stubbed up through a roof or an arcade shall be flashed with a waterproof flashing. Refer to Division 07 for additional requirements.
26. Bushings and locknuts for rigid steel conduit shall be steel threaded insulating type. Setscrew bushings are not permitted.
27. Flex conduits shall be cut square and not at an angle.
28. Routing of conduits may be changed providing length of any conduit run is not increased more than 10 percent of the length indicated on Drawings.

B. Underground Requirements:

1. Conduits and multicell raceways installed underground shall be entirely encased in 3 inch thick concrete on all sides 3, except where otherwise specified. Provide required spacers to prevent any deflection when concrete is placed and to preserve position and alignment. Conduits and raceways shall be tied to spacers. Anchors shall be installed to prevent floating of conduits and raceways during placing of concrete. Provide red colored concrete to encase conduits of systems operating above 600 volts.
2. Underground conduits and raceways shall be buried to a depth of not less than 24 inches below finished grade to top of the concrete envelope, unless otherwise specified.
3. Assemble sections of conduit with required fittings. Cut ends of conduit shall be reamed to remove rough edges. Joints in conduits shall be provided liquid-tight. Bends at risers shall be completely below surface where possible.
4. Conduits and raceways in a common trench shall be separated by at least 3 inches of concrete. Electrical power and/or lighting conduit runs installed in a common trench with conduits containing signal system wiring such as public address, telephone, intrusion detection, fire alarm, television, computer networking, and clock systems shall maintain a separation of a minimum of 6 inches from these types of signal system conduits and raceways. Electrical power, lighting and signal conduits and raceways installed in a common trench with other utility lines such as gas, water, sewer and storm lines shall maintain 12 inches separation from these types of utility lines.
5. The IOR will observe underground installations before and during concrete placement. A mandrel shall be drawn through each run of conduit in presence of the IOR before and after placing concrete. Mandrel shall be 6 inches in length minimum, and have a diameter that is within 1/4 inches of diameter of conduit to be tested.

6. Non-metallic conduit installations shall comply with following additional requirements. Joints in PVC conduit shall be sealed by means of required solvent-weld cement supplied by conduit manufacturer. Non-metallic conduit bends and deflections shall comply with requirements of applicable electrical code, except that minimum radius of any bend or offset for conduits sized from 1/2 inch to 1-1/2 inches inclusive shall not be less than 24 inches. Bends at risers and risers shall be PVC-coated rigid steel conduit. Radius of curve of bends or offsets in non-metallic conduit for public telephone system shall be not less than 10 times trade size of conduit, unless otherwise specifically permitted.
  7. Furnish and install a 6-inch wide, polyethylene, red underground barrier type 12 inches above full length of concrete reading, "CAUTION ELECTRIC LINE BURIED BELOW".
  8. Underground conduit systems provided for utility companies shall be furnished to meet the requirements of the utility companies requiring service.
  9. Protect inside of conduit and raceway from dirt and rubbish during construction by capping openings.
  10. Add bell-end bushings for conduit stub-up including underground entries to pull boxes, and manholes. Under floor standing switchboards and motor control centers provide a 4" galvanized nipple with ground bushing.
  11. Underground conduit for systems operating above 600 volts shall be a minimum size of 4 inches.
  12. At portable classroom all stub ups shall be installed with a coupling flush to finish grade.
  13. All underground conduits and raceways shall be swabbed prior to wire pull.
- C. General Installation Requirements for Computer Network System Conduits:
1. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Drawings shall not be scaled to determine position and routing of wireways, drops, and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place and must be ascertained in the field before start of Work.
  2. The maximum pulling tensions of the specified cables shall not be exceeded and proper radius of cable bends shall be maintained.
  3. For computer network wiring, conduit types shall be limited to rigid metal conduit, electrical metallic tubing, schedule 40 PVC, multi-cell raceways, and flexible metallic conduit for lengths less than 6 feet.
  4. Interior section of conduit run shall be not longer than 100 feet and shall not contain more than 2 bends of 90 degrees between pull points or pull boxes.
  5. The inside radius of a conduit bend shall be at least 6 times the internal diameter of the conduit. When the conduit size is greater than 2 inches, the inside radius shall be at least 10 times the internal diameter of the conduit. For fiber-optic cable, the inside radius of a conduit bend shall be at least 10 times the internal diameter of the conduit.
  6. Conduit shall be sized in accordance with Table 4.4-1 of EIA/ TIA 569 standard.
  7. Splicing or terminating cables in pull boxes is not permitted.
  8. For indoor application, a pull box shall be provided in conduit run where:
    - a. The length is over 100 feet.
    - b. There are more than 2 bends of 90 degrees.
    - c. There is a reverse bend in the run.

9. Boxes shall be provided in a straight section of conduit and shall not be installed in lieu of a bend. The corresponding conduit ends are to be aligned with each other. Conduit fittings shall not be installed in place of pull boxes.
10. Where a pull box is provided with raceways, pull box shall comply with the following:
  - a. For straight pull-through, provide a length of at least 8 times the trade-size diameter of the largest raceway.
  - b. For angle and U-pulls:
    - 1) Provide a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade-size diameter of the largest raceway, this distance being increased by the sum of the trade-size diameters of the other raceways on the same wall of the box.
    - 2) Provide a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
      - a) Six times the trade-size diameter of the raceway; or
      - b) Six times the trade-size diameter of the larger raceway if they are of different size.
      - c) For a raceway entering the wall of a pull box opposite to a removable cover, provide a distance from the wall to the cover of not less than the trade-size diameter of the largest raceway plus 6 times the diameter of the largest conductor.
11. Drawings generally indicate Work to be installed, but do not indicate all bends, transitions of special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits and wireways are to be installed, and furnish and install required fittings.

D. Slabs on Grade:

1. Unless specifically reviewed by the Architect and DSA, conduits 1-1/4 inches and larger are not permitted to be installed in structural concrete slabs. Where conduits are permitted, and are installed in concrete slabs on grade, slabs shall be thickened at bottom where conduits occur to provide 3 inches of concrete between conduit and earth. Required excavation shall be part of the Work of this section.
2. If concrete slab is 5 inches or more in thickness with a moisture barrier plastic sheet between earth and slab, one inch and smaller conduits shall be installed in the slab with a minimum of one inch concrete between earth and conduit.

- E. Concrete Walls, Beams, and Floors: Provide sleeves where conduits pierce concrete walls, beams, and floors, except floor slabs on grade. Sleeves shall provide 1/2 inch clearance around conduits. Sleeves shall not extend beyond exposed surfaces of concrete and shall be securely fastened to forms. Where conduits pass through walls below grade, caulk with required sealant and backer materials between conduit and sleeve to provide a watertight joint. Sealant shall be as indicated in Section 07920: Joint Sealants.

3.2 STUBS

- A. Panelboard: Install 2 one inch conduits from each flush mounted panelboard to access under floor space and to access above ceiling space where these conditions occur. Cap conduits with standard galvanized pipe caps.

B. Floor: At points where floor stubs are indicated in open floor areas, for connections to machines and equipment, conduits shall be terminated with couplings, tops flush with finished floor. Stubs shall extend above couplings the indicated distance. Where capped stubs are designated, couplings shall be closed with cast iron plugs with screw drive slots.

C. Underground:

1. Underground conduit stubs shall be terminated at locations indicated, and shall extend 5 feet beyond building foundations, steps, arcades, concrete walks and paving. Rigid metallic conduit stubs and non-metallic conduit stubs shall be capped by installing a coupling flush in end wall of concrete encasement and plugging with a permitted plug. Project record drawings shall indicate location of ends of underground conduit stubs fully dimensioned and triangulated with reference to buildings or permanent landmarks. These dimensions, including depth below finished grade, shall be marked on project record drawings in presence of the IOR before backfilling trench. Where extending existing concrete encased stubs, clean, chip and wire brush end of existing concrete and brush on a heavy coat of neat cement paste or epoxy bonding agent.

2. Over ends of individual underground conduit stubs or groups of conduit stubs, install 4-inch x 18-inch deep PVC filled with concrete, flush with finished grade in asphaltic concrete or lawns, and 2 inches above finished grade in planting areas. Cast a 3-inch x 3-inch brass plate engraved "ELECT" flush in top of concrete. Secure plate to concrete with brass dowels or as indicated on drawings.

3.3 3.03 PROTECTION

A. A. Protect the Work of this section until Substantial Completion.

3.4 3.04 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

## SECTION 26 09 23

### LIGHTING CONTROL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
  - 1. Furnish and install a low-voltage lighting control system, as indicated on the Drawings and as specified.
  - 2. Systems shall be furnished with networkable relay panels each complete with the required relays, transformers, and control electronics. The system shall be furnished with all hardware and resident software, occupancy sensors, constant light controllers, exterior light sensors, occupancy sensors, local wall switches and dimmer switches and all required conduit and wiring for a complete and functional installation.
- C. Related Sections:
  - 1. Basic Electrical Requirements – 26 05 00.
  - 2. Basic Electrical Materials and Methods – 26 05 01.
  - 3. Low-Voltage Wires (600 Volt AC) – 26 05 19.
  - 4. Raceways Fittings and Supports – 26 05 33.
  - 5. Panelboards and Signal Terminal Cabinets – 26 24 16.
  - 6. Lighting – 26 51 13.

##### 1.2 SUBMITTALS

- A. Provide in accordance with Division 01.
- B. Submit a complete one-line diagram of the proposed system configuration for Architect/Engineer's review. The riser diagram shall identify but not be limited to all wiring, equipment, components, interconnection with other systems, and location and type of raceways.
- C. Manufacturer's Data: Submit catalog cuts and description of each system component.
- D. Provide wiring diagrams and installation details for lighting control equipment.
- E. Shop Drawings: Submit a complete set of detailed Shop Drawings for the entire lighting control system; the shop drawings shall include but not be limited to relay panels with designations and dimensions, and system components with manufacturer's part numbers.
- F. Installation Instructions: Submit manufacturer's written installation instructions, wiring diagrams. Instructions shall include recommendations for handling of equipment and parts, and protection and storage requirements.

### 1.3 QUALITY ASSURANCE

- A. Components shall be listed and labeled by Underwriter's Laboratories (UL), or another Nationally Recognized Testing Laboratory (NRTL).
- B. Lighting Control Systems shall comply with the state of California Building and Electrical Codes, and Title 24 energy requirements in effect at time of submittal for building permit.

### 1.4 WARRANTY

- A. Manufacturer shall provide a 3 year material warranty.
- B. Installer shall provide a 2 year labor warranty.

### 1.5 SYSTEM REQUIREMENTS

- A. The lighting control system must be able to communicate with fully digital centralized relay panels, remote relay panels, digital switches, photocells, analog switches, various interfaces, and shall include all operational software. The lighting control system shall be integrated into a single system, except for areas controlled by a motion sensor; such as rooms with one luminaire and emergency fixtures designed to operate 24 hours a day, 7 days a week. Distributed lighting control shall be provided using a networkable remote relay panel. A Centralized relay panel shall control corridors and site lighting. Lighting control system shall include all hardware and software; software shall be resident within the lighting control system. System shall provide local access to all programming functions at the master Lighting Control Panel (LCP) and remote access to all programming functions via dial-up modem and through any standard computer workstation running an industry standard internet browser. Lighting control system shall have a server built into the master LCP that "serves" HTML pages to any authorized workstation. WEB front end shall be accessible over an SBCUSD provided Ethernet 10/100 Mbps to the local area network. Protocol shall be TCP/IP and allow either http (hypertext transfer protocol) or https (hypertext transfer protocol secured) connections. Desktop computers are not part of this section and will be provided by others. Non-networked, non-digital, non-server capable systems are not acceptable.
- B. System software shall provide real time status of each relay, each zone and each group.
- C. Lighting control system shall be able to be monitored and take commands from a remote Personal Computer (PC); should the remote PC go off-line all system programming uploaded to the lighting control system shall continue to operate as intended. Systems requiring an on line PC or server for normal operation are not acceptable
- D. All devices shall be able to be pre-addressed at the factory. Systems requiring field addressing only are not acceptable.
- E. All programs, schedules, time of day, etc., shall be held in non-volatile memory at power failure. At restoration of power, lighting control system shall implement programs required by current time and date.
- F. System shall be capable of flashing lighting OFF/ON for any relay or lighting zone prior to the lights being turned OFF. The warning interval time between the flash and the final lights off signal shall be definable for each zone. Occupant shall be able to override any scheduled OFF sweep using local lighting zone override switches within the zone or occupied space. Occupant override time shall be pre-programmed not to exceed two hours, or current California Title 24 requirements.



- G. The system shall be capable of implementing ON, OFF, Raise (dimming), and Lower (dimming) commands for any relay, group or zone by means of digital specification grade line voltage type wall switches, analog low voltage switches, photocells, web based software, or other devices connected to programmable inputs in the lighting control system.
- H. The lighting control system shall provide the ability to control each relay and each relay group. All programming and scheduling shall be able to be done locally at the master LCP and remotely via dial up modem and via the Internet. Remote connection to the lighting control system shall provide real time control and real time feedback.
- I. System may consist of centralized relay panels, remote relay panels, digital switches, analog switches, photocells, motion sensors, lumen control devices, dimmer switches, and various digital interfaces. Verify exact components specified. Remote relay panels, smart breaker panels, centralized relay panels and digital switches shall communicate as one network. Where Remote Relay Panels (RRP) are indicated on drawings, they shall control all lighting fixtures in that area or space, provide power to occupancy sensors and take input from daylight and occupancy sensors. RRP's shall be capable of taking inputs from SBCUSD specification line voltage type switches, and if classroom dimming is indicated on the plans, they shall be capable of outputting an independent 0v - 10v dimming signal for each remote relay provided. All remote relay panels, switches, photocells and occupancy sensors shall be wired per lighting control manufacturers instructions.

#### 1.6 LIGHTING CONTROL OVERVIEW-BY AREA CONTROLLED

##### A. Corridors and Open Areas:

- 1. Corridors and other common areas are controlled by a combination of programmable low voltage keyed switches and time schedules supplied by the networked lighting control system.
  - a. Low voltage keyed switches are operable 24 hours a day and are used to manually switch lights ON and OFF as required.
  - b. The central timer is used to automatically sweep lights OFF after hours, and provide other scheduling capability as necessary.
  - c. Interior corridors also require occupancy sensors.

##### B. Exterior Security Lights:

- 1. Exterior wall packs and security lights are controlled via exterior light sensors. (Refer to article 2.06)
  - a. When natural light level is insufficient, the lights are ON.
  - b. When natural light level is sufficient, the lights are OFF.

##### C. Exterior, Non-Security Lights:

- 1. Exterior parking lot lights, pathway lights and decorative lights are controlled by an exterior light sensor in conjunction with time schedules provided by the networked lighting control system.
  - a. When natural light level is insufficient or the timer is ON, the lights are ON.
  - b. When natural light level is sufficient or the timer is OFF, the lights are OFF.

## PART 2 - PRODUCTS

### 2.1 CENTRAL LIGHTING CONTROL PANELS

- A. Central Lighting Control Panels (CLCP) shall be located in the electrical closets and shall be Douglas PWEX Series or LC & D #GR-2400 series or approved equal. Panels shall be surface or flush mounted type as indicated on Drawings, with a hinged door assembly. Doors shall be furnished with flush type locks, spring latching, Corbin locks for metal doors, keyed to Corbin No. 60 keys. Panels shall include the following components or features:
1. Shall be preprogrammed and preassembled with all required control equipment and relays as indicated on the lighting plans.
  2. Shall be equipped with suitable dividers separating Class 1 and Class 2 compartments, 120v and 277v compartments as well as "normal and emergency" compartments.
  3. Lighting control relays as indicated on Drawings. Provide 10% spare relays for all centralized relay panels up to the maximum capacity of panel.
  4. Shall be equipped with a neatly typewritten schedule with number and name of rooms or areas served by the relay circuits. Room numbers and names used shall be determined at the Project site and may not be those indicated on Drawings. Schedule shall indicate panel designation and voltage and shall be mounted in a frame under transparent plastic 1/32" thick on inside of panel cabinet.
  5. Each panel shall be rated for 120 or 277 VAC.
  6. Shall be preassembled, preprogrammed and include relays capable of switching 20 amps lighting loads for 120 or 277 VAC.
  7. Central lighting control panels, remote lighting control panels, relays, low voltage switches, interior light sensors, exterior light sensors, and associated control electronics shall be furnished by Lighting Control and Design (LC & D), Douglas Lighting Controls, or approved equal.

### 2.2 REMOTE LIGHTING CONTROL PANELS

- A. Remote lighting control panels shall be mounted in the ceiling space per plans and shall be LC&D GR-2404 Series or Douglas WSP-2718. Each panel shall be connected to the network lighting control system using manufacture's recommended wiring method and configured using central lighting control software. Add a printed label "RLCP" to the T-bar grid below the RLCP".
- B. Each remote relay panel shall contain the following hardware features:
1. Programmable, matrix able switch inputs
  2. 12 VDC and 24 VDC inputs for occupancy sensors requiring DC voltage.
  3. DC power supply rated for 250 ma for supplying power to occupancy sensors.
  4. Digital light sensor inputs.
- C. Switch inputs are to be capable of switching individual relays, local groups of relays within the panel or global groups of relays system wide. Each switch input can be configured for connection to momentary 24 VAC switches or maintained contact 24 VAC switches. Each input can also be configured to be ON, OFF or Toggle.
- D. The remote panels shall accept 12 or 24 VDC or 24 VAC occupancy sensors. The inputs may be configured for OFF only or ON/OFF switching scenarios. It shall be possible to link the photo sensor control with occupancy sensing so that when light levels are high

enough, the occupancy sensor will not switch the photo controlled relays ON.

## 2.3 RELAYS

- A. Relays shall be warranted for a minimum of 3 years.
- B. Relays shall be individually added or replaced. Lighting control systems not capable of replacing individual relays are not acceptable.
- C. Each lighting control relay shall be capable of controlling incandescent, fluorescent, electronic ballast and HID lighting loads. Relays not rated for all types of lighting loads are not acceptable.
- D. Relays shall be:
  - 1. Single Pole: Douglass WR-6161, LC&D SL-277-NC, or equal.
  - 2. Double Pole: Douglass WR-6172, LC&D SL-480-NC, or equal.

## 2.4 LOW VOLTAGE SWITCHES

- A. All low voltage switches shall be wired per the lighting control manufactures requirements. Digital switches shall be part of the lighting control system network. Analog switches shall be wired to lighting control panel designated by manufacturer. Use LC&D Chelsea series or Douglas WNS-2000 series or Owner approved analog switch.
- B. Physical removal of any single switch shall have no effect on the communication between relay panels in the rest of the lighting control network. Lighting control systems requiring the continuous connection of all low voltage switches are not acceptable.
- C. Keyed switches shall be analog or digital and connect to programmable inputs in the nearest lighting control panel or be digital and connect to the lighting control system network. Use Douglas WR-8200 Series or LC&D KS Series approved equal.
- D. Provide stainless steel switch covers as specified.
- E. Local switches controlling lights in classrooms shall be wired to programmable inputs in the remote lighting control panels. Each switch shall be [programmable to control one, some or all relays in the entire network ON only, OFF only or ON & OFF. Use standard toggle switches as specified or digital low voltage switches by lighting control manufacturer as indicated on plans.
- F. Switches controlling the “quiet time” function in the remote lighting control panels shall connect directly to programmable inputs within the panel or connect to the lighting control system network. Use standard toggle switches or digital low voltage switches by lighting control manufacturer as indicated on plans.
- G. High abuse areas (common areas, gymnasiums, etc.) shall be controlled using a vandal resistant, touch sensitive high abuse switch and available with up to three buttons in a single gang. Multi gang versions shall also be available. Touch pads shall be stainless steel and capable of handling both high abuse and wash down locations. High abuse switches shall be digital or analog. Each high abuse switch touch button shall be able to control any relay or any group in any panel or panels that is part of the lighting control system. Each touch button shall be able to be programmed for ON, OFF, Toggle or Maintain operation. All programming shall be done locally or remotely via dial up modem or web interface as described in other paragraphs of this section. High abuse switches shall be able to be enabled or disabled digitally. Each touch pad is to be identified as to function by an engraved label. Switches must be capable of handling electrostatic

discharges of at least 30,000 volts (1cm spark) without any interruption or failure in operation.

## 2.5 EXTERIOR LIGHT SENSORS

- A. Provide one exterior rated light sensor for control of all exterior lights. Use Douglass WPS-5941 or LC&D PCO.
- B. One exterior light sensor shall permit different relays to switch at different light levels. Sensors offering less than 14 remotely settable trip points are note acceptable.
- C. Exterior light sensor shall continuously monitor the true light level and shall broadcast this level over the lighting control network. Sensors requiring adjustments at the sensor head are not acceptable.
- D. Exterior light sensor shall be fully adjustable via the networked lighting control system. Controllers requiring adjustments at the sensor head are not acceptable.

## 2.6 DIMMING BALLAST CONTROLLER

- A. If plans indicate classrooms and other areas to be dimmed, remote relay panels shall be capable of outputting one independent 0V – 10V dimming signal for each relay provided in the remote relay panel. All dimming ballasts shall be controlled by industry standard 0V-10V control input. Ballasts using proprietary control protocols shall not be acceptable. In order to maximize daylight harvesting and minimize disruption to occupants, each dimming output shall provide adjustment for baseline, start point, mid point, end point, trim fade up rate, fade down rate, time delay and enable/disable masking. All photocell settings must be remotely accessible. Systems that provide ON, OFF with Time Delay only and systems that do not provide remote access are not acceptable.
- B. Mount photocells in locations indicated on plans and according to manufacturer's recommendations for daylight system type, open or closed loop. All trip points shall be able to be changed remotely via internet or dial up modem. Photocells requiring manual trip point adjustment are not acceptable. Photocell used for interior lighting control shall have multiple settings such as start-point, mid-point, off-point, fade-up rate, fade-down etc. All settings shall be remotely accessible and adjustable. Systems that provide local adjustments only are note acceptable. Photocells are to be certified to be in compliance with California Energy Commission Title 24 requirements at time of submittal of plans for building permit. Use Douglass WPC-5533, LC&D iPC series, or approved equal.

## 2.7 LIGHT LEVEL CONTROLERS (EXISTING FACILITIES)

- 1. Controller shall be capable of detecting changes in lighting levels; it shall utilize an internal photoconductive cell to measure light levels through 50 percent diffused lens.
- 2. Controller shall be capable of controlling any type of lighting. It shall be a self-contained 24 VDC device that controls lighting through use of power switch packs.
- 3. Controller shall be capable of turning lighting on and off between 10 and 200 foot-candles.
- 4. Controller shall be furnished with an adjustable dead-band feature of 10 percent to 100 percent, to prevent lighting from cycling when lighting goes on and off and from minor changes due to cloud cover.
- 5. Controller shall be furnished with an adjustable time delay range of 3 seconds to 5 minutes.

6. Controller shall be furnished with a dual color LED-indicating status of sensor. LED shall have an on level with one color and an off level with another.
7. Adjustments and mounting hardware shall be concealed under a removable cover, to prevent tampering with adjustments and hardware.
8. Each controller shall be furnished with a convenient by-pass provision, which will enable lighting to be turned on in event of failure.
9. Manufacturers: Watt Stopper No. LS-100 XA, or equal by Leviton, Sensor Switch, or Unenco.

## 2.8 UNIT INVERTERS

Unit Inverters shall be rapid start type consisting of emergency fluorescent power packs designed to be installed in channels of new lighting fixtures.

- A. Power pack construction shall be of durable polycarbonate housing having same size as low profile rapid start ballast.
- B. Power pack construction shall be of durable polycarbonate housing having same size as low profile rapid start ballast.
- C. Power pack construction shall be of durable polycarbonate housing having same size as low profile rapid start ballast.
- D. Units shall be furnished with test switches and pilot lights.
- E. Units shall automatically power designated fluorescent lamp(s) in fixture to provide a minimum of 1100 lumens for 90 minutes of emergency service upon failure of utility power.
- F. Upon return of utility power, battery shall automatically recharge for future emergency use.
- G. Batteries shall be field-replaceable, sealed, rechargeable, spill-proof, maintenance-free nickel cadmium.
- H. High efficiency inverter/charger design shall include low-voltage disconnect to prevent deep discharge of battery and dual voltage designed for connection to either 120 or 277 volts. Chargers shall recharge fully discharged batteries to provide 90 minutes operation within 24 hours. An additional hot wire shall connect to unit in order to signal unit in event of a power failure. Power pack will not operate if shut off manually.
- I. An unconditional 5 year warranty is required.
- J. Units shall be Dual-Lite UFO-5 Series, Bodine, or equal.

## 2.9 INTERFACE TO BUILDING MANAGEMENT SYSTEM

- A. When interface to the Building Management System is required, the lighting control system shall provide a BACnet/IP interface module that communicates with the BMS via a BACnet/IP network (a collection of one or more IP sub networks (IP domains) that are assigned a single BACnet network number). Verify if interface to BMS is required.
- B. BACnet/IP interface module shall provide the capability for the BMS to:
  1. Communicate directly with each relay in the lighting control system network and each group used within the lighting control system.

2. Monitor the current status and status changes of each relay and each group.
- C. Electrical contractor shall be responsible for installing, wiring and confirming operation of the lighting control BACnet/IP interface module per the lighting control manufacturer's instructions. Installing, wiring, and interfacing of BMS components to the lighting control system are not the responsibility of the electrical contractor.

### **PART 3 – EXECUTION**

#### **3.1 GENERAL**

- A. Lighting control system shall not be used for any other purpose other than its intended use and application.
- B. Provide all required interconnections with other systems such as emergency power sources, fire alarm systems, and building management system as required or indicated on drawings.
- C. Installation shall meet or exceed standard practice of workmanship and quality.
- D. Drawings generally indicate work to be provided, but do not indicate all bends, transitions, or special fittings required to clear beams, girders or other work already in place. Investigate conditions where conduits are to be installed, and furnished and install required fittings.

#### **3.2 INSTALLATION AND SET-UP**

- A. Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas. Refer to manufacturer's drawings for location of line and low-voltage areas.
- B. Provide for classroom Owner specified line voltage type switches, and wire according to lighting control manufactures requirements.
- C. Digital switches and wire shall be according to lighting control manufactures requirements.
- D. Central lighting control panels and remote lighting control panels are connected via a dataline (Douglas uses a non-polarized Beldon No. 8471 LC&D use Cat5 4 twisted pair cable, with RJ45 end connectors). Connect entire lighting control system per manufacturer's requirements. Do not exceed manufacturer's total dataline length requirement.
- E. Panels shall be located so that they are readily accessible and not exposed to physical damage.
- F. Panel locations shall be furnished with sufficient working space around panels to comply with the California Electrical Code.
- G. Panels shall be securely fastened to the mounting surface by at least 4 points.
- H. Unused openings in the cabinet shall be effectively closed.
- I. Cabinets shall be grounded in accordance with Article 250 of the California Electrical Code, and manufacturer's recommendations.

- J. Lugs shall be suitable and listed for installation with the conductor being connected.
- K. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.
- L. Maintain the required bending radius of conductors inside cabinets.
- M. Clean cabinets of foreign material such as cement, plaster and paint.
- N. Distribute and arrange conductors neatly in the wiring gutters.
- O. Follow the manufacturer's torque values to tighten lugs.
- P. Before energizing the panelboard, the following steps shall be taken:
  - 1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.
  - 2. Remove shipping blocks from component devices and the panel interior.
  - 3. Remove debris from panelboard interior.
- Q. Follow manufacturers' instructions for installation.

### 3.2 OPERATING/SERVICE MANUALS

- A. Service and Operation Manuals:
  - 1. PROTECTION Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted.
  - 2. Provide a printed copy of the systems configuration as programmed, including all system labeling codes, and passwords.
  - 3. Provide an electronic copy on compact disk of the system configuration program.
  - 4. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on cables. Programming forms of systems shall be submitted with complete information.
  - 5. Record Drawings: Provide a copy on vellum of Project site and building drawings, indicating location of equipment, conduit and cable runs, and other pertinent information.
- B. Protect the Work of this section until Substantial Completion.

### 3.3 TESTING

- A. Set-up, commissioning and testing of the lighting control system, and Owner instruction shall include:
  - 1. Confirmation of system programming.
  - 2. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors.
  - 3. Operation of system's features under normal and emergency operations.
  - 4. Before energizing check and demonstrate in the presence of the IOR that cables

and wire connections are free from short circuits, ground faults, and that there is continuity, and necessary insulation.

5. Confirm system operations and functionality.
6. Check system interface response to other systems such as fire alarm and emergency power system conditions.
7. Demonstrate in the presence of the IOR that
8. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

#### 3.4 INSTRUCTION PERIODS

- A. Before Substantial Completion, arrange and provide an eight hours Owner instruction period for designated personnel.

#### 3.5 SPARE PARTS

- A. Provide a minimum of 5% spare parts of each type of relay, sensors, switches, and peripheral devices.

#### 3.6 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION



## SECTION 26 22 13

### LOW-VOLTAGE TRANSFORMERS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes: Transformers as specified and as indicated on the Drawings.
- C. Related Sections:
  - 1. Basic Electrical Materials and Methods – 26 05 01.
  - 2. Low Voltage Wires (600 Volts AC) – 26 05 19.
  - 3. Panelboards and Signal Terminal Cabinets – 26 24 16.
  - 4. Division 26: Low Voltage Systems

##### 1.2 DESIGN REQUIREMENTS

- A. Transformers, Dry Type: Distribution transformers shall be constructed and tested in accordance with ANSI, NEMA and IEEE Standards, and shall be wound with copper conductors. Performance of transformers shall meet or exceed ANSI, NEMA and IEEE published criteria. Distribution transformers rated 15 KVA and larger, except K-rated transformers, shall meet or exceed the latest requirements of the California Energy Commission Appliance Efficiency Regulations.
- B. Transformers shall be self-cooled type with 220 degrees C. insulation and a maximum temperature rise of 150 degrees C. under continuous full load conditions with an ambient of 40 degrees C.
- C. Transformers shall be furnished with four 2.50 percent (2 above and 2 below normal voltage) taps. Windings shall be of fire-resistant type, designed for natural convection cooling through normal air circulation.
- D. Core mounting frames and enclosures shall be of welded and bolted construction with sufficient mechanical strength and rigidity to withstand shipping, installation, and short circuit stresses.
- E. Enclosure cover plates shall be sheet steel, captive bolted to enclosure framework. Enclosure shall provide suitable ventilating openings with rodent-proof screens, NEMA 1 enclosure. Enclosure shall be provided with lifting lugs and jacking plates as required. Transformers installed outdoors shall be provided with weatherproof NEMA 3R enclosure.
- F. Transformers shall be furnished complete with mounting channels and mounting bolts. Metal parts, excepting cores and core mounting frames shall be furnished clean, rust-proofed, and provided with a coat of an inert primer.
- G. Transformers up to 35 KVA shall be no more than 40 decibels. Transformers 36 KVA or more shall be a minimum of 5 decibels below NEMA standards per unit. Transformers shall be provided with vibration dampers consisting of Korfund spring loaded shock

mounts and Elastorib sheeting. Size and number of shock mounts shall be in accordance with manufacturer's recommendations.

- H. K-rated transformers shall provide a rating of NL-UL K-4 or NLP-UL K-13, as indicated on Drawings, and shall furnish the following features:
  - 1. Electrostatic shield.
  - 2. NLP series shall have a maximum sound level of 3 dB below NEMA standards.
  - 3. Double-size neutral terminal.
  - 4. Additional coil capacity to compensate for higher non-linear load loss.
  - 5. Heavy-gage ventilated indoor enclosures (provide weather shields where installed indoors).
  - 6. K-rated transformers shall meet all other requirements of this section.

### 1.3 SUBMITTALS

- A. Provide in accordance with Division 01.
- B. Shop Drawings: Include make, catalog number, dimensions, finish, type, insulation class, design temperature, and taps provided. Include regulation at 80 percent and 100 percent of full load, no-load loss, full-load loss, percent efficiency, percent impedance, noise level and continuous capacity rating. Provide a connection schematic.
- C. Test Reports:
  - 1. No-Load Losses.
  - 2. Total Losses.
  - 3. Applied Voltage.
  - 4. Temperature Rise.
  - 5. Induced Voltage.
  - 6. Sound Level.
  - 7. Impulse Test.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. Transformers shall be Square D, General Electric, MGM or owner approved equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Transformer core frame shall be installed level on shock absorbing pads within enclosure. Comply with CBC zone 4 seismic requirements.
- B. Mounting bolts on floor mounted transformers shall be extended into pads only and shall not be in direct contact with building structural members.
- C. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits or bus ducts where required.
- D. Transformers installed outdoors or below grade shall be mounted on concrete pads as specified in Section 03300: Cast-In-Place Concrete.

- E. Install transformer ventilation openings not closer than 6 inches from wall surfaces.
- F. Do not install transformers in corrosive environments such as swimming pool pump and boiler rooms, or similar areas.

### 3.2 VOLTAGE CHECK

- A. Set taps on transformers to provide satisfactory operating voltages with present loads energized, including new loads and existing loads. A check shall be performed in the presence of the IOR at a panel fed from each transformer, which is farthest from transformer. Voltages at transformers ranging from 118 to 122 volts inclusive, for 120 volt systems and proportionately equivalent for higher voltage systems are permitted.
- B. Provide instruments and accessories required to perform checks. Voltmeters shall be accurate within .075 percent or one percent and shall have scales permitting voltage readings to be performed on upper half of scale. Calibration of the meters shall be observed by the IOR.
- C. Adjust transformer taps under full load operating conditions, to provide normal operating voltages at the loads.

### 3.3 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

### 3.4 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

END OF SECTION

## SECTION 26 24 13

### SWITCHBOARDS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
  - 1. Furnish, install and connect main switchboard, including metering facilities as required by utility company.
  - 2. Main switchboards shall be complete with pull, service, and distribution sections.
  - 3. Protective devices in main switchboard shall be furnished with a minimum symmetrical short-circuit interrupting rating, as provided by electric utility company.
  - 4. Provide installation detail and seismic anchorage notes for switchboards.
- C. Related Sections:
  - 1. Cast-In-Place Concrete – 03 30 00.
  - 2. Basic Electrical Requirements – 26 05 00.
  - 3. Basic Electrical Materials and Methods – 26 05 01.
  - 4. Low Voltage Wires (600 Volt AC) – 26 05 19.
  - 5. Service Entrance – 26 05 04.
  - 6. Division 26: Low Voltage Systems.

##### 1.2 SUBMITTALS

- A. Provide in accordance with Division 01.
- B. Shop Drawings:
  - 1. Include a front elevation indicating dimensions and locations of equipment on switchboard, make, kind and size or capacity of equipment and bussing, location of each service conduit entering switchboard, barriers, nameplate inscriptions, finish, total weight and size of switchboard and locations and sizes of anchor bolts.
  - 2. Contractor shall submit short-circuit and coordination studies signed and stamped by a registered electrical engineer. Studies shall be in accordance with IEEE guidelines. Contractor shall submit two copies of each study for Architect-Engineer review prior to ordering and installing any equipment.
  - 3. Provide coordination study for main and branch circuit protective devices including transformers secondary protective devices. Study shall be recorded on log paper. The circuit protective devices shall be set based on the coordination study. A final written record of protective device settings shall be provided to Architect-Engineer.

#### PART 2 - PRODUCTS

##### 2.1 SWITCHBOARDS

- A. General Description: Switchboards shall be product of W.A. Benjamin Electric, Cuttler Hammer, General Electric, or equal, and shall conform to the following requirements:

1. Complete assembly, including steel framing and covers, bus system, and breaker mounting, shall satisfy applicable provisions of UL 891 and NEMA PB-2 and the California Electrical Code for low-voltage distribution switchboards. Switchboards shall be furnished with UL labels.
2. Switchboards shall be floor standing, dead front, dead rear, line bussed, front operated and connected, circuit-breaker type, unless otherwise indicated and shall contain equipment indicated and specified. Switchboard shall be complete with pull, service, and distribution sections as required.
3. Required equipment shall be enclosed in fully interchangeable die formed steel sectional cabinets with top and bottom plates and required braces and gussets so that cabinets will be absolutely rigid, plumb and uniform in size. Each cabinet shall be a separate and independent unit with assembly holes die-stamped or jig drilled; openings for interconnections shall be so placed that any cabinet can be located in any position in assembly without drilling or cutting holes on job. Deliver switchboard to Project site in completely assembled sections and provide required assembly bolts and blanking plates. Front plates and doors shall be of not less than 12 gage furniture steel, completely removable, secured to cabinet with machine screws, with cup washers uniformly and symmetrically spaced. Provide hinged wire gutter covers for distribution sections. Equipment shall meet NEMA and UL standards.
4. Main circuit breaker or main fusible switch shall be as follows:
  - a. Main circuit breakers shall be automatic, one-piece molded-case, trip-free, common trip, quick-make, quick-break, thermal-magnetic with solid state trips, bolted to bus with frame size and trip ratings as indicated on drawings. Voltage, amperage ratings and number of poles shall be as indicated on breakers. Main breaker shall provide a minimum short-circuit interrupting capacity as determined by utility company. Provide shunt-trip and integral ground fault devices, as indicated on drawings. Breakers shall be furnished with lockout provisions.
  - b. Main fusible switch 800 amps or larger ampacity shall be high pressure contact, stored energy, quick-make/quick-break operation, with current limiting fuses, as indicated on Drawings. Provide shunt-trip, and integral ground fault devices, as indicated on Drawings. Were required, switches shall be motor operated and be furnished with an electrical trip mechanism piloted by output of ground fault sensing circuitry. Switch shall be furnished with lockout provisions.
5. Feeder circuit breakers shall be automatic, one-piece molded-case, trip-free, common trip, quick-make, quick-break, thermal-magnetic or solid state type bolted to bus, with handles clearly indicating tripped position. Breakers shall be furnished with a single handle with no tie-bar. Voltage, amperage, and number of poles shall be as indicated on Drawings. Breaker ratings shall be on handle or label. Breakers shall be furnished with lockout provisions approved by the State of California for padlocking and shall provide a minimum symmetrical short-circuit interrupting rating, as indicated on Drawings. Series rated circuit breaker combinations are not acceptable.
6. Fusible feeder switches shall be quick-make, quick-break, voltage rating and number of poles as indicated on Drawings, with visible blades and dual horsepower ratings. Switch handles shall physically indicate on and off positions. Switches shall be lockable only in off position and accept 3 industrial type heavy-duty padlocks. Switch covers and handles shall be interlocked to prevent opening in on position. Provide means to permit authorized personnel to release interlock for inspection purposes. Switches shall be equipped with Class R current limiting fuses or dual element fuse of size and capacity indicated on Drawings.
7. Utility metering provisions shall meet requirements of serving utility and shall be furnished with necessary fittings.

8. Provide for all switchboard silver-plated copper bus bars of same capacity as main breaker, or as indicated on Drawings, between current transformer and main section and distribution sections; also, full height of breaker space in distribution portions. Copper bus shall have current density of 1000A per square inch of cross section. Bus structure shall be free-fitted, and shall have sufficient strength to withstand short-circuit as indicated on drawings. Connections shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade 5 machine screws secured with constant pressure-type locking devices. Bus bar bracing shall be designed to withstand maximum available short-circuit current. Connections for cables to all circuit breakers, switches and motor control devices shall be heavy-duty mechanical pressure type terminal lugs. Provide service cable lugs as required by utility company. Cables and internal wiring shall be supported with suitable cleats.
9. Switchboard distribution sections shall be furnished with full height bussing. Unused spaces shall be provided with blank covers. Switchboards, as complete units, shall be given single short-circuit current ratings by manufacturer. Such ratings shall be established by actual tests by manufacturer, in accordance with UL specifications, on equipment constructed similarly to the furnished switchboard.
10. Provide nameplates for components on switchboards. Plates shall be black and white plastic nameplate stock, with characters cut through black exposing white, and shall bear designation of service, or feeders controlled and fuse size. Provide similar nameplates for meter and transformer compartments. A large nameplate identifying switchboard, indicating service voltage, function and current rating shall be furnished with 3/16 inch engraved block letters.
11. Paint cabinets, framework and plates inside and out with one coat of rust-resistant metal primer and one coat of gray enamel, baked on, or lacquer sprayed on.
12. Manufacture boards according to reviewed Shop Drawings. Switchboard shall meet requirements of legally constituted authorities having jurisdiction, and respective serving utility.
13. Switchboards installed outdoors shall be weatherproof NEMA Type 3R enclosure. Enclosure construction shall be formed of code gage galvanized steel with ANSI No. 61 gray enamel finish. Heavy-duty, 3-point latching, vault type door handles with padlocking provisions shall be furnished on doors. Padlocks shall be furnished keyed to Corbin No. 60 keys. Switchboards installed outdoors shall be specifically required to maintain service during extreme outdoor ambient temperatures of a minimum of 150 degrees Fahrenheit in NEMA Type 3R enclosures.
14. For grounded wye electrical service switchboards rated more than 150 volts, to ground and 1,000 amperes or more, provide ground fault protection for main protective device. Ground fault protection shall be UL listed, with ground sensor encircling all phase conductors and neutral conductors integral with the main protective device. Provide testing of ground fault protection system by an independent recognized testing laboratory. Testing lab shall provide necessary testing equipment at the Project site and perform a certified test on ground protection system in presence of the IOR. The ground fault setting shall be selected to coordinate with downstream circuit protective devices. Verify that the system neutral is grounded at the service entrance switchboard only, except neutrals of step down distribution transformers. For branch circuit protective devices, rated 800 amps or more, provide ground fault protection where shown on the drawings, or as described above, for main protective device. Coordinate settings with main protective device ground fault protection.
15. In main and distribution switchboards provide a multifunctional digital meter with true RMS measured Amperes (each phase and neutral) Volts (line-to-line and line-to-neutral), Power Factor, Frequency, VA, VAR, Watts, KWH, KVARH, KVAH, voltage/current unbalance, and demand metering: W, VAR, Amperes, VA. Meter to have a front mounted RS232 port to allow programming and meter values via

laptop computer and supplied software. The meter shall be equal to GE Multiline PQM.

- 16 Connections to any bussing shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade 5 machine screws secured with constant pressure-type locking devices.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Switchboards shall be located so that they are readily accessible and not exposed to physical damage.
- B. Switchboard locations shall provide sufficient working space around the switchboard to comply with the California Electrical Code.
- C. Switchboards shall be securely fastened to the mounting surface.
- D. Switchboard cabinets shall be grounded as specified in Article 250 of the California Electrical Code.
- E. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.
- F. Lugs shall be suitable and as required for installation with the conductor being connected.
- G. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.
- H. Maintain the required bending radius of conductors inside the cabinet.
- I. Distribute and arrange conductors neatly in the wiring gutters.
- J. Tightening the wire lugs or any conductor connections shall be performed in the presence of the IOR. Torque values shall be those recommended by manufacturer.
- K. Remove shipping blocks from component devices.
- L. Manually exercise circuit breakers to verify they operate freely.
- M. Remove debris from switchboard interior.
- N. Follow manufacturer's instructions for installation.
- O. Furnish one spare fuse for each fusible switch installed. Spare fuses shall be of the same type and rated as those installed.
- P. Do not install in highly corrosive environments such as pool equipment, boiler, chemical and corrosive materials storage rooms, and similar areas. When equipment is installed in such areas, it shall be labeled and listed for the application.

#### **3.2 PADS AND ANCHORING**

- A. Where free-standing equipment is installed at exterior locations or in locations below grade, concrete pads shall be provided as specified in Section 03300: Cast-In-Place Concrete.

- B. Where a utility meter is installed in a switchboard, concrete pad shall extend 3 feet from face of switchboard door or board, whichever is greater. Concrete pad installation shall comply with electric utility company requirements.
- C. Anchor bolts for freestanding equipment shall meet California seismic zone 4 requirements, and manufacturer's installation recommendations. The more stringent requirements will be enforced.
- D. Project Record Documents: Provide project record drawings of switchboards as installed, indicating main and branch circuit ratings, circuit numbers and part numbers.
- E. For ground fault relays and sensors, the following information shall be provided:
  - 1. Certified Calibration and Acceptance Test.
  - 2. Installation Instructions.
  - 3. Operating Instructions.
  - 4. Maintenance Instructions.
  - 5. Replacement Parts List.
  - 6. Final Test Report.
- F. Test information shall be submitted to the Architect. Nameplates may be fabricated of engraved laminated plastic or etched metal and shall be permanently attached with escutcheon pins or screws.

### 3.3 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

### 3.4 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION



## SECTION 26 24 16

### PANELBOARDS AND SIGNAL TERMINAL CABINETS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes: Lighting and power distribution facilities, including panelboards.
- C. Related Sections:
  - 1. Basic Electrical Requirements – 26 05 00.
  - 2. Basic Electrical Materials and Methods – 26 05 01.
  - 3. Panelboards and Signal Terminal Cabinet – 26 24 16.
  - 4. Lighting – 26 51 13.
  - 5. Division 26: Low Voltage Systems.

##### 1.2 SUBMITTALS

- A. Provide in accordance with Division 01.
- B. Shop Drawings: Include a front elevation indicating cabinet dimensions, make, location and capacity of equipment, size of gutters, type of mounting, finish, and catalog number of locks. General layout of internal devices, wiring drawings with wire numbers and device connections, vendor cut sheets of devices in enclosure and bill of materials listing description, manufacturer, part number, and quantity of items shall be included.
- C. Installation Instructions: Submit manufacturer's written installation instructions.

##### 1.3 DESIGN REQUIREMENTS

- A. Panelboards:
  - 1. Panelboards shall be wall-mounted, enclosed safety type with 120/240 volt, 3-wire solid neutral 277/480 volt, 4-wire or 120/208 volt, 4-wire solid neutral mains as indicated on Drawings or specified. First panelboard of each building shall be provided with main or sub-feeder circuit breakers where so indicated.
  - 2. Single pole branches shall be molded case, thermal magnetic circuit breakers with inverse time delay, trip free, quick-make, quick-break mechanism and silver alloy contacts. Circuit breakers shall be fully rated, with ampere rating marked on handle and shall indicate on/off and tripped positions. Ground fault interrupters shall be incorporated into circuit breakers where indicated. They shall be listed by UL, or other NRTL as ground fault devices. Provide appropriate lug kit of sufficient size to accommodate the feeders.
  - 3. Two- and 3-pole branches shall be enclosed, and shall be thermal magnetic circuit breakers with inverse time delay, tamper-proof, ambient compensated, single handle, internal common trip, and quick-make, quick-break mechanism with silver alloy contacts. Circuit breakers shall be fully rated or as otherwise indicated on the Drawings.
  - 4. Main and subfeeder circuit breakers shall be enclosed, thermal magnetic type with inverse time delay, single handle common trip, quick-make, quick-break

mechanism, corrosion-resistant bearings and silver alloy contacts. Ampere frame size and trip rating shall be as indicated on Drawings. Breakers over 225 amperes shall be furnished with interchangeable trip units. Handles of main and subfeeder circuit breakers shall be provided cabinet door. Voltage rating shall be as indicated on Drawings.

5. Circuit breakers shall be fully rated and of one-piece, bolt-on type and shall meet short-circuit interrupting capacity requirements indicated on Drawings. Series rated circuit breaker combinations are not acceptable
  6. Internal connections shall be fabricated with plated copper bus bars and the busses shall extend for full length of space available for branch circuit breakers. Feeder cable connectors shall be installed at point of feeder entrance. Terminals shall be furnished with copper conductors. Panelboards fed by conductors having over-current protection greater than 200 amperes shall be protected on supply side by over-current devices having a rating not greater than that of panelboards. Copper bussing shall be fully rated. Heat rated bussing is not acceptable
  7. Except where otherwise indicated, circuit breakers shall be in 2 vertical rows connected to bus bars in a distributed phase arrangement. Two-pole branches shall be balanced on busses. Single pole branches shall be numbered adjacent to its circuit breaker, with odd numbers on left and even numbers on right.
  8. Specified circuit breaker spaces shall be furnished with hardware required for future installation of circuit breakers.
  9. Provide locking devices for individual circuit breakers. Padlocking devices shall be secured to circuit breakers and by panel dead front plates.
- B. Surge Suppressors: Where indicated on Drawings, provide transient voltage surge suppressors as an integral part of panelboards. Panelboards shall be complete with 200 percent rated copper neutral bus, ground bus and isolated ground bus in addition to requirements of this section. Surge suppressors shall be as follows:
1. Surge Capacity:
    - a. Line-to-neutral for wye systems: 80 KA.
    - b. Line-to-ground: 80 KA.
    - c. Neutral-to-ground: 80 KA, 3-phase wye.
    - d. Line-to-neutral plus line-to-ground: 160 KA.
  2. UL 1449 2<sup>nd</sup> Edition Suppressed Voltage Rating for 208/120 Wye System:
    - a. Line-to-neutral: 400 volts.
    - b. Line-to-ground: 400 volts.
    - c. Neutral-to-ground: 400 volts.
    - d. Maximum continuous over-voltage: 150 volts.
  3. EMI/RFI High-Frequency Noise Power Filter (Characteristics):
    - a. 100 KHz at 44 dB.
    - b. 100 MHz at 44 dB.
    - c. 10 MHz at 44 dB.
    - d. 100 MHz at 44 dB.
  4. MOVs shall be thermally protected for low current faults and shall be fused with surge-rated fuses. The surge-rated surge current passes and clears the circuit safely if the surge capacity is exceeded. Enhanced diagnostics shall continuously monitor the unit's status and shall include LEDs to signal a reduction in surge capacity or the loss of a suppression circuit. An audible alarm, with test and silence features, shall be furnished in diagnostic package.
  5. Each phase or the entire unit shall be replaceable and have bolted-on, tin-plated copper connections. Unit to have UL witnessed fault current rating of 65,000 symmetrical amperes.
  6. Surge suppression units shall comply with the following:
    - a. UL certified.
    - b. UL 1283.

- c. UL 1449 2<sup>nd</sup> Edition.
- d. IEEE C 62.45.
- e. IEEE C 62.41.
- f. Nationally Recognized Testing Laboratory (NRTL) or equal

C. Panelboard Cabinets:

- 1. Panelboard cabinets shall be code gage galvanized steel or blue steel; fronts, doors, and trims shall be code gage furniture steel. Cabinets shall be furnished with at least 6-inch high gutters at top and bottom where feeder cable size exceeds 4 gage or where feeder cable passes through cabinet vertically. Cabinets shall be furnished with top and bottom gutters sized as required by inspection department having jurisdiction, but never less than 6 inches where more than one feeder enters top or bottom of cabinets. Side gutters shall not be less than 4 inches wide. Width of cabinets shall be 20 inches, unless otherwise indicated on Drawings.
- 2. Doors shall be cut true, shall accurately fit opening and finish smooth across joints. Rabbets shall be inside. Hinges shall be entirely concealed except for barrels and pins. Hinge flanges shall be welded to door and trim. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors, keyed to Corbin No. 60 keys.
- 3. Where contactors, time switches, and control devices are specified or indicated to be installed within panelboard cabinets, a separate compartment and door shall be provided at top of cabinet for such devices. Door shall be sized as required to permit removal of contactor and other devices intact. Gutters shall be provided at sides and top of compartment. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors keyed to Corbin No. 60 keys.
- 4. Provide and install panelboard manufacturer's permanent circuit number kit option.
- 5. Panelboards with control devices in compartment shall arrive at the Project site completely assembled with control devices installed and wired.
- 6. Outdoor cabinets shall be NEMA Type 3R. Construction shall be formed from code gage galvanized steel with ANSI No. 61 gray enamel finish. Provide heavy-duty, 3-point latching, vault type door handles with padlocking provisions. Provide stainless steel or galvanized butt hinges on doors. Padlocks shall be furnished, keyed to Corbin No. 60 keys.
- 7. Self-tapping screws and bolts not permitted.

D. Panelboard Schedule: Provide a neatly typewritten schedule with number or name of room or area, or load served by each panelboard circuit. Room numbers or names shall be determined at the Project site and shall not necessarily be those indicated on the Drawings. Schedule shall also indicate panel designation, voltage and phase, building and distribution panel or switchboard from which it is fed. Schedule shall be installed in a frame under transparent plastic 1/32 inch thick on inside of each panelboard cabinet door.

E. Panelboard Standards: Panelboards shall be UL, or other NRTL listed and labeled. Panelboards shall meet latest revisions of following standards:

- 1. California Electric Code, Article 384.
- 2. UL 67, Panelboards.
- 3. UL 50, Cabinets and Boxes.
- 4. UL 943, GFCI.
- 5. UL 489, Molded Case Circuit Breakers.
- 6. NEMA PB1.
- 7. Federal Specifications W-P- 115C and WC-375B.

F. Signal Terminal Cabinets:

1. Signal terminal cabinets shall conform to the Specifications for panelboard cabinets, except as modified herein.
2. Terminal cabinets shall be flush type, with 2-inch trim or surface mounted type, as indicated on Drawings. Terminal cabinets shall be furnished with sections and barriers to separate each system. Sections over 24 inches in width shall be provided with double doors and locks. Terminal cabinets, or sections of terminals housing separate systems, shall measure 12 inches long x 18 inches high x 5-3/4 inches deep, unless otherwise indicated on Drawings. Trims for sectional cabinets shall be of one-piece construction.
3. Terminal cabinets shall be furnished with 3/4 inch thick plywood. Plywood shall be fastened in place with machine screws or factory installed mounting screws.
4. Flush-mounted terminal cabinets shall be finished as specified for flush-mounted panelboard cabinets. Surface and semi-flush mounted terminal cabinets shall be finished as specified for surface-mounted panelboard cabinets.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Panelboards shall be manufactured by W.A. Benjamin, General Electric, Cutler Hammer, Square D or equal.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Panelboards shall be located so they are readily accessible and not exposed to physical damage.
- B. Panelboards installed outdoors shall be specifically listed for wet locations and shall be weatherproof in NEMA Type 3R cabinets.
- C. Panelboard locations shall provide sufficient working space around panels to comply with the California Electrical Code.
- D. Panelboards shall be securely fastened to structure and mounted on surface by at least 4 points.
- E. Unused openings in cabinets shall be effectively closed as required by the manufacturer.
- F. Cabinets shall be grounded as specified in Article 250 of the California Electrical Code.
- G. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.
- H. Lugs shall be suitable and listed for installation with the conductor being connected.
- I. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.
- J. Maintain the required bending radius of conductors inside the cabinet.

- K. Clean the cabinet of foreign material such as cement, plaster, and paint.
- L. Distribute and arrange conductors neatly in the wiring gutters.
- M. Use the manufacturer's torque values to tighten lugs.
- N. Before energizing panelboards, the following steps shall be taken:
  - 1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been provided.
  - 2. Remove shipping blocks from component devices and panelboard interiors.
  - 3. Manually exercise circuit breakers to verify they operate freely.
  - 4. Remove debris from panelboard interior.
- O. Follow manufacturer's instructions for installation.
- P. Do not install in highly corrosive environments, unless rated for the application.

### 3.2 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

### 3.3 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

## SECTION 26 51 13

### LIGHTING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Provisions of the General and Supplementary Conditions and Division 01 apply to this section.
- B. Section Includes: Furnishing and installing lighting fixtures, including lamps, ballasts, wiring, and lighting controls.
- C. Light fixtures model numbers were determined at the time this specification was written; model numbers may need to be modified, or may require the addition or deletion of options to fully meet specification requirements.
- D. Related Sections:
  - 1. Section 26 05 00: Basic Electrical Requirements
  - 2. Section 26 05 01: Basic Electrical Materials and Methods.
  - 3. Section 26 05 26: Grounding and Bonding
  - 4. Section 26 05 19: Low-Voltage Wires (600 Volts AC)
  - 5. Section 26 09 23: Lighting Controls
  - 7. Section 02770: Site Concrete Work

##### 1.2 SUBMITTALS

- A. Provide in accordance with Division 01.
- B. List of Materials: Submit a complete list of materials proposed for this section.
- C. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of sockets, size of lamps, and complete details of method of fitting suspension and fastening fixtures in place. Provide wiring diagrams for lighting control equipment. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.
- D. Prior to start of construction, provide photometric calculations with graphic of luminance levels of work plane, ceiling and walls of each representative classroom, library and multipurpose room. Calculations shall comply with IESNA recommendations.
- E. Installation Instructions: Submit manufacturer's written installation instructions for fixtures and accessories.
- F. Submittals must comply with contract general provisions.

- 1.03 MOUNTING REQUIREMENTS
- A. Design of lighting fixtures, accessories, supports, and method of fixture installation shall comply with requirements for earthquake-resistant construction of the State of California.
  - B. Provide suspension points at no more than 2 feet from fixture ends. Spacing between supports shall not exceed 8 feet.
- 1.04 QUALITY ASSURANCE
- A. Components and fixtures shall be listed and approved for the intended application by Underwriter's Laboratories (UL), or other Nationally Recognized Testing Laboratory (NRTL).
  - B. Owners approval shall be obtained for any equipment or materials substitutions.
- 1.05 GUARANTEE
- A. Provide a 2 year labor warranty.
  - B. Provide material warranty as specified:
    - 1. Lamps: 2 years
    - 2. Ballasts: 5 years
    - 3. Standards: 1 year
    - 4. Controls: 3 years
  - C. Warranty period begins at substantial completion or project acceptance for beneficial occupancy.

## **PART 2 - PRODUCTS**

- 2.1 MATERIAL AND FABRICATION
- A. Lighting fixtures shall be the type indicated on Drawings and as specified. Fixtures of same type shall be of one manufacturer.
  - B. Fixtures shall be of the types and manufacturers described in the FIXTURE TYPES section below, with lamps, wattage and voltage as indicated on Drawings. Specific manufacturer and model number references are indicated as a standard of performance and quality; other manufacturers' models may be supplied provided the product meets or exceeds the specifications. The alternate fixtures must achieve the same photometric levels and uniformity ratios.
  - C. All fixtures shall be baked-on enamel or powder-coated, unless otherwise specified in subsections below.
  - D. Fluorescent fixtures shall be equipped with low or tall profile, medium Bi-Pin fluorescent lamp holders of high-strength, and quickwire pressure terminals with recessed wire wells to insulate against shorting. Lamp holders shall be manufactured of chemical-resistant thermoplastic body and be equipped with a captive nut.

## 2.2

### LAMPS AND BALLASTS

#### A. Fluorescent Lamps and Ballasts

1. Approved Ballast Manufacturers:
  - a. Osram Sylvania
  - b. Advance
  - c. Universal-Triad
  - d. Lutron
  - e. General Electric
2. Ballast Type and Characteristics
  - a. High efficiency program-start unless otherwise noted.
  - b. Dimming ballasts where indicated shall be for 0-10 volt DC control circuits, or 2 wire variable inputs such as Advanced Mark 10 series. Ballasts shall be specifically compatible with the lighting control system being provided.
  - c. Power Factor >90
  - d. Harmonic distortion <15%
  - e. ANSI 82.11 color-coded
  - f. Class A noise rated
  - g. Comply with applicable state, federal, and industry standards including FCC 47, part 18 non-consumer RFI/EMI standards, and IEEE standards for line voltage transient protection and harmonic distortion.
  - h. 0 degrees Celsius minimum starting temperature.
  - i. Ballast per schedule as follow:
    - 1) RLO=reduced light output, ballast factor 78% or less.
    - 2) NLO=normal light output, ballast factor nominal 88%.
    - 3) HLO=high light output, ballast factor nominal 120%.
- B. Approved Lamp Manufacturers:
  - a. Osram Sylvania ("Sylvania" or "OSI")
  - b. General Electric,
  - c. Philips
2. Lamp Characteristics:
  - a. Color Temperature: All lamps shall be 4100K unless indicated otherwise in lighting fixture schedule, or lighting drawings.
  - b. T-8 Lamps
    - 1) Four-foot unless otherwise indicated. Lamps shall be rate 3150 nominal initial lumens at 32 watts - GE "HL," Sylvania "Xtreme" or Philips "Advantage," no substitutes.
    - 2) Color Rendering Index (CRI) shall be 82 minimum, unless indicated otherwise in lighting fixture schedule or lighting drawings.
    - 3) Low-mercury type meeting federal "T-clip" standards.
    - 4) All lamps must be from same manufacturer and batch.
  - c. Compact Fluorescent Lamps
    - 1) CF42, CF32, and CF26: triple tube amalgam, four pin lamp.
    - 2) CF13: twin tube, four pin lamp.
    - 3) Other lamps as indicated in lighting fixture schedule or lighting drawings.
    - 4) All lamps must be from same manufacturer and batch.



## 2.3 LIGHT STANDARDS

- A. Standards shall be 25 feet high, tapered galvanized steel, unless otherwise indicated on Drawings.
- B. Pole shaft shall conform to ASTM A595 Grade A and be 11 gauge thickness, unless otherwise indicated on Drawings. Shaft shall be one piece construction with a full length longitudinal high frequency resistance weld.
- C. The anchor base shall be constructed from structural quality hot rolled carbon steel plate conforming to ASTM A36.
- D. Anchor bolts shall be fabricated from commercial quality hot rolled carbon steel bar with minimum yield strength of 55,000 PSI. Bolts shall have an L bend on one end and threaded on the opposite end. Anchor bolts shall be hot dipped galvanized with a minimum length of 12 inches on the threaded end. Four properly sized bolts furnished with two hex nuts, and flat washers, shall be provided for each pole. Contractor to obtain manufacturer required base bolt pattern prior to concrete installation.
- E. A two piece base cover shall completely seal the entire base plate and anchorage and it shall be securely fastened.
- F. Each pole shall have a 3" x 5" handhole. A nut holder shall be provided near the handhole and shall include a ½" – 13 UNC HE x Head bolt and nut for grounding. The handhole shall be welded in the pole shaft and shall include a steel cover with attachment screws. The handhole shall be located 18" above the base of the pole.
- G. Finish of pole and accessories shall be electrostatically applied, and thermally cured polyester powder coat. Color shall be selected by Architect.
- H. All structural fasteners shall be galvanized high strength carbon steel.
- I. Poles shall be designed to withstand wind velocity of 80 MPH and 100 MPH gusts. Concrete base shall be a monolithic concrete pour when installed.
- J. Standards shall be installed plumb and straight on concrete footings. Grout and dry-pack after leveling. Concrete, grout and drypack requirements and procedures are as specified in Division 2.
- K. Provide in line fuse assembly in hand hole of each light standard with breakaway receptacle Bussmann HEY series, or approved equal. Fuse assembly shall easily disconnect power to light standard. Fuse type and rating shall be as required by each application.
- L. Provide all required fixture mounting accessories.
- M. Standards shall be as manufactured by Gardco, Alcastco, Lytepole, or approved equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install a lighting fixture for each lighting outlet indicated and mark new ballasts with

day of installation.

- B. Fixture voltage shall be as indicated on Drawings.
- C. Install recessed and surface-mounted fixtures, with plaster frames compatible with ceiling and wall systems employed; secure fixtures mechanically to frames.
- D. Align rows of suspended and surface-mounted fluorescent fixtures to form straight lines at uniform elevations.
- E. Recessed fixtures shall fit snugly against ceilings to prevent light leakage.
- F. All fixture installations shall comply with California Zone 4 seismic requirements
- G. Support suspended recessed fixtures in T-bar ceilings as follows: Fixtures shall be attached to ceiling grid to resist a horizontal force equal to weight of fixtures. For heavy-duty grid systems, fixtures weighing less than 56 pounds must also have two 12 gage slack safety wires from diagonal corners to the structure above; fixtures weighing more than 56 pounds shall be independently supported by not less than 4 taut 12 gage wires capable of supporting 4 times load. For intermediate duty grid systems, fixtures shall be independently supported by not less than 4 taut 12 gage wires capable of supporting 4 times load. Fixture hanger wire ends shall be twisted 3 tight turns within a 1 ½ -inch distance. Provide positive point of attachment to T-bar ceiling with four (4), #8 wafer head tek screws (one at each corner), avoiding conflict with operation of the lens. Fixture installation shall be coordinated with acoustical ceiling installation.
- H. Emergency light fixtures shall be labeled "Emergency Fixture" with 1 inch high letters produced with a P-touch or similar labeling system.
- H. Continuous suspended fixtures:
  - 1. Fixture suspension device shall allow vertical adjustment of fixture without the use of tools. Cable shall be minimum 7 strand twisted stainless steel capable of supporting minimum four times the fixture weight. For continuous linear suspended fixtures longer than eight feet, provide not less than three suspension points.
  - 2. Top of fixture shall be suspended as shown on the Drawings, typically 24 inches below the ceiling and a minimum of 18 inches from the ceiling.
  - 3. Fixture shall utilize factory furnished or approved hardware and canopy for either hard or T-bar ceilings.
  - 4. White Board Lights shall be suspended 24 inches from the wall unless specifically shown otherwise.
- I. Where emergency battery packs are installed, provide constant hot for emergency fixtures. When powering unit inverter power packs, use the same circuit that powers the switched ballast to power the inverter.
- J. Surface mount fixtures shall be attached to structure. Toggle bolts are NOT permitted. Provide backing where required.
- K. Low level exit signs shall be installed with the bottom of the sign not less than 6 inches, or more than 8 inches above the floor level and shall indicate the path of exit travel. For exit and exit-access doors, the sign shall be on the door or adjacent to the door with the closest edge of the sign within 4 inches of the door frame.

### 3.02 TESTING

- A. Check and adjust fixtures for required illumination.
- B. Replace defective lamps and ballasts.
- C. Test and adjust lighting control equipment for proper operation.

3.03 TRAINING

- A. Training and education of lighting and control systems shall be provided by Contractor to administrative and District staff.
- B. Equipment material specifications and written training manuals shall be provided to District staff.

3.04 SPARE PARTS

- A. Furnish 10 percent spare lamps with a minimum of one spare lamp of each type.
- B. Furnish 10 percent spare motion detectors of each type with a minimum of one spare detector of each type.
- C. Furnish 10 percent spare ballasts of each type with a minimum one spare ballast of each type.

3.05 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

- A. Remove rubbish, debris, and waste materials from all areas of work each day.
- B. Clean fixture surfaces of dirt, cement, plaster and debris. Furnish cleansers compatible with material surfaces being cleaned.

3.07 HAZARDOUS WASTE DISPOSAL

- A. All hazardous waste disposal shall be handled and disposed of by an approved, licensed contractor.
- B. Any and all ballasts are assumed to contain PCB unless clearly marked "NO PCB."
- C. Place ballasts and lamps in appropriate containers provided by hazardous waste contractor labeled clearly with:
  - 1. Project Name
  - 2. Quantity of lamps
  - 3. Date lamps became waste
- D. Store, remove, transport and dispose of hazardous materials in all accordance with state and federal regulations.
- E. Provide Owner with copy of manifest and certificate of destruction.

END OF SECTION

## SECTION 31 00 00

### EARTHWORK

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES:

- A. Site inspection prior to bidding.
- B. Clearing and grubbing as required
- C. Site preparation including setting grades, identifying utilities, and protecting site features and landscaping.
- D. Excavation for site structures, slabs-on-grade, and paving.
- E. Fill under slabs-on-grade and paving.
- F. Fill for over-excavation, and planting.
- G. Consolidation and compaction.
- H. Excavation, backfill, and compaction relating to storm drains, electrical plumbing, and under slabs-on-grades, pavements, including asphaltic concrete surfacing.
- I. Provide and implement the requirements of SWPPP which shall be followed throughout the length of the contract.
- J. All permits required to accomplish work of this section
- K. Importing fill materials as required
- L. Remove and dispose of excavated material unsuitable for re-use.

##### 1.2 RELATED SECTIONS:

- A. Subsurface Investigation – 02 30 00.
- B. Cast-In-Place Concrete – 03 30 00.
- C. Storm Drainage Piping – 33 41 00.
- D. Geotechnical Investigation Report.

##### 1.3 REFERENCES:

- A. California Building Code (CBC), 2007 Part 2 Chapter 8 – Foundation and retaining walls.
- B. California Building Code (CBC) 2007 Chapter 33 site work, demolition and construction.

##### 1.4 SUBMITTALS:

- A. Submit under provisions of Section 01 33 00.

- B. Submit for approval of Architect/Engineer and Soils Engineer, prior to any deliveries to site, samples of any proposed imported fill materials.
- C. Submit verified report complying with CBC section 3301 -2007.

## **PART 2 – PRODUCTS**

### **2.1 SOILS:**

- A. See site-specific Soils Report for suitability of on-site soils to be used as engineered fill, for moisture conditioning, and for over excavation requirements.
- B. Import material, if required, shall meet the requirements as specified in the geotechnical report, and approved by the Soils Engineer.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION:**

- A. Complete Work in strict accordance with the geotechnical report.
- B. Protect adjacent properties from damage due to earthwork operations. Protect open excavations and trenches with fences, covers, or railings as required to maintain safe pedestrian and vehicular traffic.
- C. Verify that survey bench marks, survey control points.
- D. Employ a competent instrument operator to properly lay out grades and stakes, using a professional type instrument, and to be present on site during grading, excavating and filling operations.
- E. Establish elevations, and set and protect stakes during earthwork operations.
- F. Locate, Identify known underground, above ground, and aerial utilities. Stake and flag locations.
- G. Notify utility company to remove and relocate utilities in advance when required.
- H. Protect above and below grade utilities which are to remain.
- I. Protect trees, plant life, lawns, and other features remaining as a portion of final landscaping.
- J. Protect bench marks, sidewalks, paving, and curbs, either on-site or off-site, from damage due to construction, excavation equipment and vehicular traffic.

### **3.2 CUT AND FILL:**

- A. Contractor shall export all excess soil from the site as needed to complete the work. Exporting shall include excavation, removing, hauling and disposal of soil in a legal manner off site. Contractor shall pay all fees and charges related to this portion of the work.

Areas to receive fill where landscape is to occur is to receive topsoil from the excavated area(s).

### 3.3 ROUGH GRADING:

- A. The site shall be graded to the limit lines and elevations shown on the drawings with such allowances as may be required for the construction of walks, paving or other intended site improvements.

### 3.4 EXCAVATION:

- A. Underpin adjacent structures that may be damaged by excavation work, including utilities and pipe chases.
- B. Excavate subsoil required to accommodate trenching, slabs-on-grade, import fill, paving, and construction operations.
- C. Control drainage in the vicinity of the Work to prevent water from accumulating or running into the excavation or into adjacent property. Provide shoring and bulk-heading necessary to hold the earth back.
- D. When dust conditions exist, dampen the areas to prevent seepage of dust and transportation of debris into the buildings and onto adjacent property.
- E. Prevent standing water from developing in excavated portions of the Work at all times.
- F. Stockpile excavated material in areas designated on site or as directed by the Engineer. Remove all excess material not being used, from site.
- G. Shoring and bracing, provide materials for shoring and bracing such as sheet piling, uprights, stringers and cross braces comply with applicable codes, regulations and local building ordinances. Maintain shoring and bracing in excavations regardless of time period excavations.
- H. Notify architect of unexpected subsurface conditions and discontinue affected work area until notified to resume work

### 3.5 TRENCHING:

- A. Footing Trenches: After completion of rough grading and acceptance of engineered fills, excavate to widths and depths shown on the Drawings. Excavations are subject to foundation inspection.
- B. Notify the Soil Engineer two days prior to foundation trench completion and before placement of steel or forms. Foundation inspection must be completed before reinforcing steel or any form work is set. Forming of footing sidewalls shall be done only when approved by the Architect/Engineer.
- C. Hand trim trenches. Remove loose matter.
- D. Correct unauthorized excavation at no cost to Owner.
- E. Correct areas over-excavated by error or damaged by movement of the sides of the trench in accordance with this Section at no additional cost to the Owner.

### 3.6 BACKFILLING:

- A. Use only engineered or approved fill materials for required backfill. Compact in accordance with soil report.

- B. Backfill areas to contours and elevations with unfrozen materials.
- C. Maintain optimum moisture content of backfill materials to attain required compaction densities stipulated in soil report.
- D. Slope grade away from building minimum ¼" per foot, unless noted otherwise.
- E. Make grade changes gradual. Blend slope into level areas.

3.7 COMPACTION:

- A. Preparation of engineered fill areas, selection and placing of engineered fill materials, shall be in conformance with the soils report, and will be observed and tested by the Soils Engineer.
- B. Notify Soils Engineer two working days in advance of filling operations to permit required testing.
- C. Generally, compact subgrade to density requirements for subsequent backfill materials.

3.8 FINISH GRADING:

- A. Finish grades shall slope to drain without water pockets or irregularities and shall conform to the intent of the drawings after settlement and compaction of the soil. Finish grades shall meet all existing or established controls of sidewalks, curbs and walls, and shall be of uniform slope and grade between the points of fixed elevations or elevation controls from such points of the established grade.

3.9 TOLERANCES:

- A. Rough Grade: Plus or minus .10 feet of design rough grade.
- B. Top Surface of Backfilling under Paved Areas: Plus or minus .05 feet.
- C. Top Surface of General Backfilling: Plus or minus .05 feet.
- D. Top Surface of Finish Grading: Plus or minus .05 feet and/or functional use and appearance as determined by the Architect.

3.10 FIELD QUALITY CONTROL:

- A. Inspection and testing of all site grading and earth work shall be performed under the observation of the soils engineer. Cost of soils engineering services to be paid by the contractor test shall be made in accordance with ASTM D1557 and D1556, D2922, D3017. Copies of all test reports shall be submitted to the architect as the work progresses.
- B. When the relative compaction is below the percentage specified in the Soils Report, recompaction will be required until the stipulated percentage level is achieved.
- C. Laboratory tests will be based on ASTM D1557 to determine conformance with the recommendations of the Soils Report.
- D. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.11 ADJUSTING:

- A. Restore, to the satisfaction of the Architect/Engineer, street pavements, walks, curbs, gutters, and trees, which become damaged in the performance of the Work.
- B. After completion of the Work, remove rubbish and equipment from the site.

3.12 PROTECTION:

- A. Protect finished work.
- B. Recompact fills subjected to vehicular traffic.
- C. Leave fill material stockpile areas completely free of excess fill materials.
- D. Before working over backfill, verify that such work has been properly backfilled and compacted. Promptly notify the Architect/Engineer, in writing, of contrary conditions.
- E. Prevent displacement of banks and keep loose soil from falling into excavation, maintain soil stability.

3.13 DUST CONTROL:

- A. Use all means necessary to control dust on and near the work on and near off-site burrow areas.
- B. Thoroughly moisten surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the site.

3.14 AIR QUALITY

- A. The contractor is responsible to ensure implementation of all applicable Best Available Control Measures, specific requirements found in SCAQMD Form 403 N specific for the project as required by the CEQA final initial study/Mitigated Negative Declaration Project Report.
- B. Contractor shall be responsible during construction that onsite traffic speed limits are reduced to 15MPH on all unpaved roads as required by CEQA mitigation Measure AQ-3.
- C. The contractor is responsible for having the proper equipment available during all the phases of construction to water down all of the active areas and unpaved haul routes a minimum of three (3) times daily as required by CEQA Mitigation Measure AQ-2.
- D. The contractor is responsible during construction that soils stabilizers are applied to all inactive areas remaining idle for more than one week as required by CEQA Mitigation Measure AQ-5.
- E. The contractor is responsible to ensure that following construction activities ground cover shall be placed in disturbed areas as soon as possible and that all landscaping of unpaved areas is done in a timely manner as required by CEQA Mitigation Measure AQ-5.
- F. The contractor is responsible during construction activities that the rough grading and the precise grading do not overlap per CEQA mitigation measure AQ-6.



- G. The contractor is responsible during construction activities that no more than 5 acres of the site can be graded /disturbed per day as require per mitigation measure AQ-7

END OF SECTION

## SECTION 31 11 00

### SITE CLEARING

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION:

- A. Work Included: Provide all material, labor, equipment and services necessary to do all clearing of work site for site improvements and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded. Confine cleared areas to minimum area required to accomplish proposed Work. This Section includes:

1. Remove organic matter and vegetation, crops, topsoil and debris.
2. Remove pavement structural section and concrete slab.
3. Clear site of plant life and grass where authorized for removal.
4. Remove trees and shrubs where authorized.
5. Remove root system of trees and shrubs where authorized.
6. Remove any irrigation structures, power poles, power lines, guy wires, irrigation valves, standpipes, and similar items where authorized.
7. Excavate topsoil and strip project site.
8. Remove existing utilities where said utilities are indicated to be removed on the Drawings.
9. Remove buried objects encountered.

See Specification Section 02050 Demolition for demolition of structures.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Subsurface Investigation – 02 30 00.
- B. Earthwork – 31 00 00.

##### 1.3 REGULATORY REQUIREMENTS:

- A. Conform to applicable codes for disposal of debris.
- B. Coordinate clearing work with the Owner.

#### PART 2 – PRODUCTS

Not Used

#### PART 3 – EXECUTION

##### 3.1 PREPARATION

- A. Verify that existing plant life to be removed has been authorized for removal.
- B. Examine site and compare with the Drawings and Specifications.
- C. Thoroughly investigate and verify conditions under which the Work is to be performed.

### 3.2 PROTECTION

- A. Locate, stake and flag, and protect utilities that remain from damage.
- B. Protect trees, plant growth, and features designated to remain as final landscaping.
- C. Protect bench marks and existing structures from damage or displacement.
- D. Maintain designated site access for vehicle and pedestrian traffic.

### 3.3 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove trees and shrubs within marked areas. Remove stumps and main root ball of all trees being removed.
- C. Clear undergrowth and dead wood without disturbing subsoil.

### 3.4 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.

### 3.5 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be regraded.
- B. Stockpile in area designated on site to depth not exceeding 8-feet. Protect from erosion. Remove excess topsoil not being reused, from site.
- C. Excavate wet topsoil prior to any treatment of subsoil for stabilization; i.e. lime treatment or cement treatment.

### 3.6 PROPERTY AND BUILDING LAYOUT

- A. Establish building locations with appropriate offsets to allow for grading work.
- B. Reset property stakes, if required.
- C. Reset bench mark, if required.
- D. Define locations of paving, walks and other site features including underground utility locations.
- E. Verify inverts or flowlines of existing utility structures adjacent to the site or to be connected to, including, but not limited to, stubs, laterals, catch basins, junction boxes and manholes.
- F. After horizontal layout, verify elevations of adjacent surfaces to be connected to (i.e. existing driveway aprons) and report any discrepancies to Architect/Engineer.

END OF SECTION

## SECTION 31 23 00

### EXCAVATION AND FILL

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

##### 1.2 RELATED SECTIONS

- A. Section 31 00 00 - Earthwork
- B. Section 03 30 00 - Cast-in-Place Concrete.

##### 1.3 REFERENCES

- A. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)); 2000a.
- C. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2006.
- D. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2005.
- E. California Building Code (CBC), Part 2, Chapter 18A - Foundation and Retaining Walls.
- F. California Building Code (CBC), Part 2, Chapter 33A - Sitework, Demolition and Construction.
- G. Geotechnical Investigation Report No. 07-81-370-01, dated 03-28-2008, by Converse.

##### 1.4 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

##### 1.5 SUBMITTALS

- A. Materials Sources: Submit name of imported materials source.
- B. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- C. Compaction Density Test Reports.

##### 1.6 PROJECT CONDITIONS

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary and approved by the District, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.

2. Prevent contamination.
  3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

## **PART 2 PRODUCTS**

### **2.1 FILL MATERIALS**

- A. Natural material used for structural backfill may be selected from the excavation but must be accepted as satisfactory backfill material by the Geotechnical Engineer. No unacceptable material shall be used in fills.
- B. General Fill: Subsoil excavated on-site.
1. Graded.
  2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
  3. Conforming to ASTM D 2487 Group Symbol CL.
- C. Concrete for Fill: Lean concrete.
- D. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
1. Grade in accordance with ASTM D 2487 Group Symbol GM.
- E. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
1. Grade in accordance with ASTM D 2487 Group Symbol SW.
- F. Topsoil: Friable loam; imported borrow.
1. Select.
  2. Graded.
  3. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.
  4. Conforming to ASTM D2487 Group Symbol OH.

### **2.2 SOURCE QUALITY CONTROL**

- A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 02310 for additional requirements.
- C. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- D. Verify structural ability of unsupported walls to support imposed loads by the fill.
- E. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

### 3.2 PREPARATION

- A. Scarify subgrade surface to a depth of 8 inches (203 mm) to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

### 3.3 FILLING

- A. Conform to Geotechnical Report. Backfill excavations as promptly as work permits, but not until completion of the following:
  - 1. Acceptance by Geotechnical Engineer and/or District Inspector of construction below finish grade including, where applicable, damp proofing, water-proofing, and perimeter insulation.
  - 2. Inspection, testing, approval, and recording locations of underground utilities.
  - 3. Removal of concrete formwork.
  - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
  - 5. Removal of trash and debris.
  - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- B. Fill to contours and elevations indicated using accepted materials.
- C. Fill up to subgrade elevations unless otherwise indicated.
- D. Employ a placement method that does not disturb or damage other work.
- E. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- F. Maintain optimum moisture content of fill materials to attain required compaction density. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface or subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
  - 1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
  - 2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to a satisfactory value, as determined by moisture-density relation tests.
- G. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.
- H. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- I. Slope grade away from building minimum 2 1/2 inches in 10 ft (63.5 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- J. Correct areas that are over-excavated.
  - 1. Corrective work shall be at the Contractor's expense.
  - 2. Load-bearing foundation surfaces: Fill with concrete or as directed by the Structural Engineer.
  - 3. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 percent of maximum dry density.
- K. Compaction Density Unless Otherwise Specified or Indicated:

1. Under slabs-on-grade and similar construction: 90 percent of maximum dry density.
2. Under paving: 95 percent of maximum dry density.
3. At other locations: 90 percent of maximum dry density.

L. Reshape and re-compact fills subjected to vehicular traffic.

#### 3.4 FILL AND COMPACTION AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Under Interior Slabs-On-Grade:

1. Use granular fill.
2. Depth: 6-inches (100 mm) deep.
3. Compact to 90 percent of maximum dry density.
4. Cover with sand.
  - a. Depth: 4 inches (102 mm).
  - b. Compact to 90 percent of maximum dry density.

C. At Foundation Walls and Footings:

1. Use general fill.
2. See Geotechnical Report for Design Parameters.
3. Do not backfill against unsupported foundation walls.
4. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

D. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:

1. Drainage fill and geotextile fabric: Section 02620.
2. Cover drainage fill with general fill.
3. Fill up to subgrade elevation.
4. Compact to 90 percent of maximum dry density.

E. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:

1. Bedding: Use sand.
2. Cover with sand to six inches above top of pipe, conduit or duct bank.
3. Fill up to subgrade elevation.
4. Compact in maximum 8 inch (200 mm) lifts to 90 percent of maximum dry density.

F. Inside Planter Boxes:

1. Use granular fill, 4 inches (100 mm) deep.
2. Cover with geotextile fabric.
3. Cover with sand, 2 inches (50 mm) deep.
4. Finish with topsoil, to within 2 inches (50 mm) of planter rim, lightly tamped.

G. At Lawn Areas:

1. Compact subsoil to 90 percent of its maximum density before placing fill.
2. Use topsoil.
3. Fill up to finish grade elevations.
4. Compact to 90 percent of maximum dry density.
5. See Section 02310 for topsoil placement.

H. At Planting Areas Other Than Lawns:

1. Use topsoil.
2. Fill up to finish grade elevations.
3. Compact to 90 percent of maximum dry density.
4. See Section 02310 for topsoil placement.

I. At French Drains:

1. Use granular fill.
  2. Fill up to 8 inches (200 mm) below finish grade.
  3. Compact to 90 percent of maximum dry density.
- J. Under Exterior Concrete Paving:
1. Compact subsoil to 90 percent of its maximum dry density before placing fill.
  2. Use 4-inch layer of sand at exterior slabs-on-grade and walkways.
  3. Fill up to four inches (102 mm) below finish paving elevation unless noted otherwise on the drawings.
  4. Compact to 90 percent of maximum dry density.
  5. Use granular fill at exterior slabs intended for vehicular traffic.
  6. Fill up to five inches below finish paving elevation unless noted otherwise on the drawings.
  7. Compact to 90 percent of maximum dry density.
- K. Under Monolithic Asphalt Concrete Paving:
1. See Geotechnical Report Design Parameters.
  2. Fill up to subgrade elevation.
  3. Maximum compacted depth of each lift: 8 inches (200 mm).
  4. Compact to 95 percent of maximum dry density.

### 3.5 TOLERANCES

- A. Top of Surfaces Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
1. Grassed Areas: Finish areas to within not more than one (1) inch above or below the required finish grade elevations.
  2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than one-half (1/2) inch above or below the required subgrade elevation. Slope all drainage away from building.
  3. Concrete Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than one-half (1/2) inch above or below the required subgrade elevation.
  4. Asphalt Concrete Pavement: Finish area to the minimum depth of the sub-base to be applied as indicated on the drawings or in these specifications.
  5. Planting Areas: Finish areas to six inches below finish grade elevations as shown to receive topsoil.
- B. Top of Surface or Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/4 inch when tested with a 10 foot straight edge.

### 3.6 FIELD QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. Subgrades and fill layers will be inspected by the Geotechnical Engineer before further construction work is performed. Test of subgrades and fill layers will be performed as follows:
1. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Architect.
  2. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2000 sq. ft. of paved areas or building slab, but in no case less than three tests. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying



building slab or paved area, but in no case less than three tests.

3. Foundation Wall Backfill: Take at least two field density tests, at locations and elevations as directed.

- C. If subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional cost to the District. Provide corrective work at the direction of the Geotechnical Engineer.
- D. Compaction density testing will be performed on compacted fill in accordance with ASTM D 1556.
- E. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor").
- F. Proof roll compacted fill at surfaces that will be under slabs-on-grade and paving.

### 3.7 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion, and keep free of trash and debris.
  - 1. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances and to include weathering of the soil. The depth of removal and recompaction shall be determined by the Geotechnical Engineer and Architect.
- B. Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

### 3.8 CLEAN-UP

- A. Surplus excavated materials shall be disposed of off-site, except approved excavation material which may be used for mounding, top soil, or other conditions approved by the Geotechnical Engineer and Architect.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

## SECTION 31 23 33

### TRENCHING FOR SITE UTILITIES

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Trenching, backfilling and compacting for utilities outside the building to utility main connections.

##### 1.2 RELATED SECTIONS

- A. Document: Geotechnical report No. 05-81-227-02, dated March 5, 2007, by Converse Consultants.
- B. 31 00 00 - Earthwork
- C. 31 23 00 - Fill and Backfill: Backfilling at building and foundations.
- E. Division 22 - Plumbing Piping.

##### 1.3 SUBMITTALS

- A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

##### 1.4 PROJECT CONDITIONS

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination.
  - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.
- D. Protect plants, lawns, rock outcroppings, and other features to remain.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

#### PART 2 PRODUCTS

##### 2.1 FILL MATERIALS

- A. General Fill: Subsoil excavated on-site.
  - 1. Graded.
  - 2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
  - 3. Conforming to ASTM D 2487 Group Symbol CL.
- B. Concrete for Fill: Lean concrete, 2500 psi minimum.
- C. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
  - 1. Grade in accordance with ASTM D 2487 Group Symbol GM.
- D. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials,

and organic matter.

1. Grade in accordance with ASTM D 2487 Group Symbol SW.

E. Topsoil: Friable loam; imported borrow.

1. Select.

2. Graded.

3. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.

4. Conforming to ASTM D2487 Group Symbol OH.

## 2.2 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage.

C. Notify utility company to remove and relocate utilities.

### 3.2 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.

G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd (0.25 cu m) measured by volume.

H. Remove excavated material that is unsuitable for re-use from site.

I. Stockpile excavated material to be re-used in area designated on site.

J. Remove excess excavated material from site.

### 3.3 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

### 3.4 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.
- F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- G. Slope grade away from building minimum 2 inches in 10 ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- H. Correct areas that are over-excavated.
  - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- I. Compaction Density Unless Otherwise Specified or Indicated:
  - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
- J. Reshape and re-compact fills subjected to vehicular traffic.

### 3.5 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping, Conduits, and Duct Bank:
  - 1. Bedding: Use sand, 4-inches deep, minimum.
  - 2. Cover with sand twelve-inches above top of pipe, conduit, or duct bank.
  - 3. Fill up to subgrade elevation.
  - 4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.

### 3.6 FIELD QUALITY CONTROL

- A. See Section 01 45 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

### 3.7 CLEAN-UP

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

## SECTION 32 12 16

### ASPHALT PAVING

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Aggregate base course.
- B. Prime Coat and Tack Coat.
- C. Single course bituminous concrete paving.
- D. Double course bituminous concrete paving.
- E. Surface sealer.
- F. Headers and accessories.

##### 1.2 RELATED SECTIONS

- A. 31 00 00 – Earthwork
- B. 31 23 00 – Excavation and Fill: Compacted subgrade for paving.

##### 1.3 REFERENCES

- A. AASHTO T 30 - American Association of State Highway and Transportation Officials.
- B. ASTM D 448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
- C. ASTM D 692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
- D. ASTM D 979 - Standard Practice for Sampling Bituminous Paving Materials.
- E. ASTM D 995 - Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving.
- F. ASTM D 1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
- G. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- H. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- I. Caltrans Standard 375 - Determining the In-place Density and Relative Compaction of Asphalt Concrete Pavement, 2003.

##### 1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with State of California Standard Specifications for Public Works Construction (Standard Specifications), 2002 Edition.
- B. Mixing Plant: Bulk asphaltic concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete. Comply with ASTM D 995.
- C. Provide asphalt under Caltrans "Certification Program for Suppliers of Asphalt". Supplier shall be a currently approved supplier.
- D. "Certificates of Compliance" shall accompany each shipment of asphalt to project site. Certificates shall include: shipment #; type of material; SG; refinery; consignee; destination; quantity; PO #; date; and statement of compliance. Certificates shall be submitted to Inspector of Record (I.O.R.).

- E. Obtain materials from same source throughout.

## 1.5 SUBMITTALS

- A. Product Data: For proprietary products, submit complete manufacturer's description literature and specifications in accordance with the provisions of Section 01300.
  - 1. Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item where applicable.
  - 2. Manufacturer's Recommendations: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, and application rates.
- B. Test Reports: Submit certified laboratory test reports confirming physical characteristics of materials used in the performance of the Work of this Section.
- C. Mixes: Submit asphaltic concrete mix design formula.
- D. Certificates: Submit certificate signed by the asphalt concrete manufacturer, that paving materials conform to specification requirements.

## 1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable state and local codes for off-site street improvement paving work.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.
- B. Place bitumen mixture when temperature is not more than 15 F degrees (8 C degrees) below bitumen supplier's bill of lading and not more than maximum specified temperature.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Asphalt Cement Binder:
  - 1. Caltrans Performance Graded PG 64-10 conforming to Standard Specification, Section 92, "Asphalts".
- B. Aggregate Base:
  - 1. Sound, angular crushed stone, crushed gravel, or crushed slag, and sand, stone or slag screenings conforming to Standard Specification, Section 26, "Aggregate Bases".
  - 2. Gradation: 3/4-inch Class 2 Aggregate Base.
- C. Aggregate for Binder Course: Standard Specification, Section 39, "Hot Mix Asphalt", 1/2-inch Maximum Medium Type B aggregate, Angular crushed washed stone; free of shale, clay, friable material and debris.
  - 1. Graded in accordance with Section 39, within the following limits:
    - a. 3/4-inch sieve: 100 percent passing.
    - b. 1/2-inch sieve: 95-99 percent passing. TV +/- 6.
    - c. 3/8-inch sieve: 75-95 percent passing. TV +/- 6.
    - d. No. 4 sieve: 55-66 percent passing. TV +/- 7.
    - e. No. 8 sieve: 38-49 percent passing. TV +/- 5.
    - f. No. 30 sieve: 15-27 percent passing. TV +/- 4.
    - g. No. 200 sieve: 2-8 percent passing. TV +/- 2.
  - 1. Graded in accordance with Section 39, within the following limits:
    - a. 1/2-inch sieve: 100 percent passing.
    - b. 3/8-inch sieve: 95-100 percent passing. TV +/- 6.
    - c. No. 4 sieve: 58-72 percent passing. TV +/- 7.

- d. No. 8 sieve: 34-48 percent passing. TV +/- 6.
- e. No. 30 sieve: 18-32 percent passing. TV +/- 6.
- f. No. 200 sieve: 2-9 percent passing. TV +/- 3.

- D. Prime Coat: Homogeneous, medium curing, liquid asphalt.
  - 1. Medium-Curing Type, Grade MC-70, conforming to Standard Specification, Section 93, "Liquid Asphalts".
- E. Tack Coat: SS-1h, Emulsified asphalt conforming to Standard Specification, Section 94, "Asphaltic Emulsions".
- F. Seal Coat: Slurry, type 2. Provide Lay Cold Walktop manufactured by Chevron Asphalt Co., or equal.

## 2.2 ASPHALT PAVING MIXES AND MIX DESIGN

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Comply with Standard Specifications Section 92, "Asphalts".
- C. Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.
- D. Submit proposed mix design for review prior to beginning of work.

## 2.3 HEADERS AND STAKES

- A. Construction Heart Grade Redwood. 2 x 4 nominal header and 1 x 2 nominal stakes. Use (2) 16d galvanized nails for fastenings, each stake.

## 2.4 WEED KILLER

- A. Provide a dry, free-flowing, dust-free chemical compound containing not less than 30-percent sodium chlorate, or a chlorate-borate compound. Product shall be non-flammable, not creating a fire hazard when applied in accordance with the manufacturer's recommendations, soluble in water, and capable of being spread dry or in solution.
- B. Product must be currently listed and approved for use in California by the Department of Pesticide Regulations.
- C. Acceptable Products:
  - 1. SpraKil SK-13 by SSI Maxim Co., Inc. Kilgore, Texas, 800-346-4781; EPA No. 34913-15.
  - 2. Spike 80DF by Dow AgroSciences, Inc.; EPA No. 62719-107.

## 2.5 SOURCE QUALITY CONTROL

- A. Test mix design and samples in accordance with California Test 367.

## **PART 3 EXECUTION**

### 3.1 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify that gradients and elevations of subgrade are correct.

### 3.2 PREPARATION

- A. Treat all subgrade with weed killer in accordance with manufacturer's instructions. Take extreme caution to confine weed poison to area covered with asphaltic concrete, and provide all necessary protection to prevent injury or damage to life or property.

### 3.3 AGGREGATE BASE COURSE

- A. Aggregates for bases shall be delivered to the roadbed as uniform mixtures and shall be deposited in layers or windrows. Segregation shall be avoided and the material shall be free from pockets of coarse and fine material.
- B. Spread, shape and compact all aggregate base material deposited on the subgrade during the same day.
  - 1. Aggregate base shall be watered in conformance with the provisions in Standard Specification, Section 17, "Watering".
- C. Place and compact aggregate base course to not less than 95 percent of maximum dry density; ASTM D 1557, Method D.
- D. Test density of compacted aggregate base course; ASTM D 2167.
- E. Conduct one test for each 2,500 square yards of in-place material, but in no case less than one daily for each layer.

### 3.4 PREPARATION - PRIME COAT

- A. Prime coat shall be applied at a temperature conforming to the range of temperatures provided in Standard Specification, Section 93-1.03, "Mixing and Applying".
- B. Apply prime coat on aggregate base or subbase at uniform rate of 1/3 gal/sq yd (1.5 L/sq m).
- C. Apply primer to contact surfaces of curbs, gutters, and other concrete surfaces.
- D. Use clean sand to blot excess primer. Remove loose sand before paving.

### 3.5 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with Standard Specification, Section 94-1, "Asphaltic Emulsions".
- B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 0.10 gal/sq yd (0.45 L/sq m).
- C. Apply tack coat to contact surfaces of curbs, gutters and construction joints.
- D. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

### 3.6 PREPARING ASPHALT MIXTURE

- A. Comply with ASTM D 995 for plant equipment and operation and Standard Specification Section 39-3, for storing, proportioning and mixing materials.
- B. Heating:
  - 1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture, conforming to Section 93, "Liquid Asphalts".
  - 2. Use lowest possible temperature to suit temperature-viscosity characteristics of asphalt but not less than 250 degrees F nor more than 375 degrees F.
- C. Aggregate:
  - 1. Deliver dry aggregate to mixer at recommended temperature to suit penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture.
  - 2. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements.
- D. Joints:
  - 1. Carefully make joints between old and new pavements, or between successive days' work, to ensure a continuous bond between adjoining work.
  - 2. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.



### 3.7 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with Standard Specifications, Section 39, "Asphalt Concrete" and Section 93, "Liquid Asphalts".
- B. Place asphalt within 24 hours of applying primer or tack coat.
- C. Place to thickness shown on the civil drawings.
- D. Install gutter drainage grilles and frames in correct position and elevation.
- E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

### 3.8 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Install Work in accordance with Standard Specification, Section 39, "Asphalt Concrete" and Section 93, "Liquid Asphalts".
- B. Place asphalt binder course within 24 hours of applying primer or tack coat.
- C. Place to thickness shown on the civil drawings
- D. Place wearing course within two hours of placing and compacting binder course.
- E. Place to thickness shown on the civil drawings.
- F. Install gutter drainage grilles and frames in correct position and elevation.
- G. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- H. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

### 3.9 INSTALLING REDWOOD HEADER

- A. Install redwood header with stakes spaced at 4-feet on centers at all transitions between bituminous concrete paving and lawn, planter or other landscaped areas, whether shown on the drawings or not.

### 3.10 PATCHING

- A. Remove and replace defective areas. Remove defective areas for full depth of course.
- B. Cut-out and fill with new, hot asphalt concrete. Cut sides perpendicular and parallel to direction of traffic with edges vertical.
- C. Compact by rolling to specified density and smoothness.
- D. Apply tack coat to exposed surfaces before placing new asphalt concrete.

### 3.11 FLOOD TEST

- A. Flood Test: Before applying a seal coat or striping, a water test shall be made in the presence of the Inspector of Record (I.O.R.). The flooding shall be done by water tank truck. All depressions, where water ponds to a depth of more than 1/8 inch shall be filled or the slope shall be corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. All corrected work of the asphalt concrete paving shall be of the same mix design.

### 3.12 SEAL COAT

- A. Apply seal coat to surface course in accordance with Standard Specification, Section 37,

"Bituminous Seals".

- B. After completing the flood test, all new A.C. pavements shall receive "Laycold Walk Top" as manufactured by Chevron Asphalt Company. The sealer shall consist of suitable fibrated chemical type asphaltic base binders and fillers having a container consistency suitable for troweling after thorough stirring. It shall contain no clay or other deleterious substances.
- C. Place the entire contents of each drum sealer in a plaster or pug mill type mixer thoroughly. Where less than 50 gallons of sealer are used, mixing may be done in a mortar box. During mixing, the sealer may be diluted with water to produce a uniform, free flowing consistency, but in no case shall it be diluted with more than one part of water to four parts of "walk top".
- D. Areas to receive Walk-Top shall be swept clean and before application, lightly sprayed with water, leaving it cool and damp, but without free water.
- E. Apply Walk Top by pouring from a can or a wheeled container in continuous parallel lines and spreading immediately with rubber-faced squeegees or with long-handled hair brooms. The squeegee or broom shall be pulled at an angle from the line of spread to continually roll the material toward the operator and not to overflow or spill over its forward edge away from the operator.
- F. Make two or more applications using at least 35 gallons of sealer (before dilution) per 1,000 square feet of area.
- G. The finished surface seal, when dry and thoroughly set, shall be smooth, tough, waterproof, resilient, of uniform black color and free from coarse textured areas, lap marks, ridges and other surface irregularities. Should and defects appear in the finished surface, apply as many additional coats of sealer as may be required to produce the specified finished surface at no additional cost. Protect from traffic during all operations and until the sealer is thoroughly set and cured and does not pick-up under foot or wheeled traffic.

### 3.13 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.
- B. Compacted Thickness: Within 1/4 inch (6 mm) of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/2 inch (12 mm).

### 3.14 FIELD QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for quality control.
- B. Vendor shall make available for review by the I.O.R., a certified copy of tests representing any shipment. If asphalt is used prior to sampling and testing, a "Certificate of Compliance", as provided in Section 6-1.07, shall accompany each shipment of asphalt to the project site. The certificate shall include the shipment number, type of material, specific gravity of material, refinery, consignee, destination, quantity, contract or purchase order number and date of shipment. The certificate shall state that the material complies with the specifications detailed in this section and shall be signed by the vendor.
- C. Provide field inspection and testing to determine thickness, density, and surface smoothness by use of a properly calibrated nuclear gauge. Select and test locations in conformance with Caltrans Standard 375.

### 3.15 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for 24 hours.
- B. Provide barricades and warning devices as required.

END OF SECTION

**SECTION 32 13 13**  
**CONCRETE PAVING**

**PART 1 – GENERAL**

1.1 SECTION INCLUDES:

- A. Concrete curbs, and curb and gutter.
- B. Concrete pavement, sidewalks, ramps and drives.
- C. Storm drain catch basins and manhole bases.
- D. Thrust blocks for water systems.
- E. Equipment bases – see Mechanical and Electrical Systems.
- F. Galvanized chain link fencing and gates. Post bases.

1.2 RELATED SECTIONS:

- A. Subsurface Investigation – 02 30 00.
- B. Concrete Forming – 03 11 00.
- C. Concrete Reinforcing– 03 20 00.
- D. Cast-In-Place Concrete – 03 30 00.
- E. Water Utility Distribution Piping – 33 11 00.
- F. Sanitary Utility Sewerage Manholes, Frames, and Covers – 33 93 13.
- G. Fire Water System – 33 12 17.
- H. Cast-in-Place Tactile Panels – 32 1701

1.3 REFERENCES:

- A. ASTM C33 – Standard Specification for Concrete Aggregates.
- B. ASTM C150 – Standard Specification for Portland Cement.
- C. ACI 318 – Building Code Requirements for Structural Concrete.
- D. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
- E. ACI 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
- F. ACI 305R – Hot Weather Concreting.
- G. ACI 306R – Cold Weather Concreting.
- E. California Building Code, International Conference of Building Officials (ICBO), current

edition.

- F. ASTM C31 – Standard Practice for Making and Curing Test Specimens in the Field.
- G. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- H. ASTM C138 – Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of concrete.
- I. ASTM C143 – Standard Test Method for Slump of Hydraulic Cement Concrete.
- J. ASTM C172 – Standard Method for Sampling Freshly Mixed Concrete.
- K. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

#### 1.4 JOB CONDITIONS:

- A. Weather Limitations: Construct concrete surface course only when atmospheric temperature is above 40 degrees F., when the underlying base is dry, and when weather is not rainy.
- B. Grade Control: Establish and maintain the required lines and grades, including cross-slope during construction operations.

#### 1.5 QUALITY CONTROL:

- A. Standard Specifications: The American Concrete Institute (ACI) "Specifications for Structural Concrete", ACI 301, shall be used as standard specification. All cast-in-place concrete shall conform to this standard specification except as modified by the requirements specified herein and/or detailed on the Drawings.
- B. Field Quality Control: Testing firm will take cylinders and perform slump and air entrainment tests in accordance with SSCDOT. A set of test cylinders shall be taken for each individual pour or placement of concrete and, in no case, shall a set of cylinders represent more than 200 cubic yards of concrete placed.

### **PART 2 – PRODUCTS**

#### 2.1 MATERIALS:

- A. Poured-in-Place Concrete: Concrete curbs, curb and gutter, ramps, drives, manhole bases and thrust blocks for water systems and fire systems shall be Class A conforming to Section 90 of State Specifications with a minimum 28 day compressive strength of 2500 psi.
  - 1. Cement – Type II modified conforming to ASTM C150, Portland cement.
  - 2. Aggregate – Maximum size  $\frac{3}{4}$ -inch diameter.
- B. Extruded Curbs, and Curb and Gutter: 3000-lb. Concrete; special no slump design mix.
- C. Expansion Joints: Homex 300 wood fibre strip (non-asphaltic) or approved equal; full thickness of slab.

### **PART 3 – EXECUTION**

3.1 EXAMINATION:

- A. Verify gradients and elevations of substrate are correct.
- B. Verify that substrate is level, smooth, and capable of supporting curbs, and curb and gutter sections. Minimum slope of concrete curb and gutter to be as shown on Civil drawings.

3.2 INSTALLATION – REINFORCING:

- A. Reinforcing is to be held firmly in place during concrete placement.

3.3 INSTALLATION – CONCRETE:

- A. Space expansion joints as shown on the drawings for flatwork for adjacent curbs, curb and gutters, and valley gutters. Align expansion joints.
- B. Exterior Walkways:
  - 1. Control Joints: After concrete has set sufficiently, mark off slabs as detailed marking straight and uniform with rounded edges and clean-cut intersections.
  - 2. Expansion Joints – Exterior Walkways and Slabs: Depth as indicated on the Drawings.
- C. Do not sawcut score lines.

3.4 FINISHES:

A. Finishes:

Slopes less than 6% to be medium broom finish.

Slopes 6% or greater to be heavy broom finish.

- B. After trowel finishing, draw a fine hair push broom over the surface at the time when such broom marks shall produce a uniform texture on the surface. Unless indicated otherwise, direction of brooming shall be perpendicular to direction of walk. Walks with inadequate amounts of texture shall be rejected. Flatwork shall be poured during the same operation. Areas of poor workmanship, as determined by the Architect, shall be removed and redone at Contractor's expense.

3.5 PROTECTION:

- A. Immediately after placement, protect concrete from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

## SECTION 32 17 00

### PAVING SPECIALTIES

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION:

- A. Work Included: Pavement markings, including driveways, parking areas, crosswalks, and playgrounds.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS:

- A. Pavement Markings: Fuller-O'Brien 382-XX, Dunn-Edwards W-801, or approved equal. Painted lines and markings on pavement shall be 3" minimum wide and blue in color equal to Color No. 15090 per Federal Standards 595B. Parking spaces for the disabled shall be marked according to CBC Section 1129B.4. Tactile warning lines shall be in conformance to CBC Section 1133B.8.3 and 1133B.8.4. Two coats minimum.
- B. Concrete wheel stops; Precast Manufacturing Company, size as shown on drawings, provide 1" pin holes for mounting rods. 4,000 psi concrete with 2-3# rebar minimum.
- C. Concrete wheel stop shall be sleeved for the dowels. Do not drill holes after concrete is cured.

#### PART 3 - EXECUTION

##### 3.1 CONDITION OF SURFACES:

- A. Surface to receive markings shall be dry, free of dust, loose material and oil.

##### 3.2 LAYOUT:

- A. Accurately lay out and align markings as per Drawing requirements.

##### 3.3 INSTALLATION:

- A. Markings: Make parking stripe widths 4" and game line stripe width 2" unless otherwise noted. Apply paint by brush or spray. Use marking templates unless approved mobile device is used. Markings, regardless of application method shall have clearly defined edges with no spatter on adjacent surfaces. Apply paint at manufacturer's recommended rate so as to fully cover in one operation.
- D. Do not apply pavement markings until after final seal coat or just prior to acceptance of project in asphalt areas.
- C. Install wheel stops in bed of epoxy adhesive, #5 rebar dowels-18" long driven flush with top of stop. Seal the dowel hole at top with silicone, exterior grade, clear sealant.

END OF SECTION