

# COLUSA HIGH SCHOOL AG BARN SITE UTILITIES

For:  
COLUSA UNIFIED SCHOOL DISTRICT  
COLUSA, CA 95932



ARCH | NEXUS

SACRAMENTO • SALT LAKE CITY

Project No. 15178

January 29, 2016

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# PROJECT MANUAL COLUSA HIGH SCHOOL AG BARN SITE UTILITIES

For:  
COLUSA UNIFIED SCHOOL DISTRICT  
COLUSA, CA 95932

Prepared By:



ARCH | NEXUS

Project No. 15178

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# COLUSA HIGH SCHOOL AG BARN SITE UTILITIES

Project No. 15178

**FOR:** Colusa Unified School District

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## **PART 1 - GENERAL**

### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

### **1.2 SUMMARY**

- A. This Section includes concrete, formwork, reinforcement, and related work as shown and specified.

### **1.3 SUBMITTALS**

- A. Product Data: Submit manufacturer's data, installation instructions and evidence of compliance with requirements of this section for the following:
  - 1. Cement: Submit certification from cement manufacturer that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C150 for Portland cement and ASTM C595 or C1157 for blended hydraulic cement, whichever is applicable.
  - 2. Reinforcement: Submit mill test and chemical analysis certificates for all reinforcing steel delivered to the site.
- B. Shop Drawings: Reinforcement shop drawings in accordance with ACI 315. Show all fabrication and installation details and dimensions, including embedded items.
- C. Mix Designs: Include record of test data per CBC 1903A. Identify mixes by design strength, intended use, and placement restrictions, such as "pump mix" or "hot weather mix".
- D. Materials List: Within 35 days after award of Contract, and before any concrete is delivered to the jobsite, submit to Architect a complete list of all materials proposed to be used in this portion of the work, showing manufacturer's name and catalog number of all items such as admixture, membrane, concrete mix design and the name and address of supplier of transit-mix concrete.
- E. Placement Records: Keep on job site until completion, and open to inspection, record showing time and date of placing concrete in each portion of structure together with transit-mix delivery slip certifying contents of each placement. Delivery placement record and delivery slips to the architect upon completion of the work.
- F. Closeout Submittals: Provide completed Guarantee form per Article 1.5.

#### **1. QUALITY ASSURANCE**

- G. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.
- H. Reference Standards:
  - 1. American Society of Testing Materials (ASTM): Materials and testing standards as identified throughout this Section.
  - 2. American Concrete Institute (ACI):
    - a. ACI 301: Specifications for Structural Concrete for Buildings.

- b. ACI 302.1R: Guide for Floor and Slab Construction.
  - c. ACI 304R: Guide for Measuring, Mixing, Transporting and Placing Concrete.
  - d. ACI 305R: Hot Weather Concreting.
  - e. ACI 306R: Cold Weather Concreting.
  - f. ACI 308: Standard Practice for Curing Concrete.
  - g. ACI 315: Details and Detailing of Concrete Reinforcement
  - h. ACI 318: Building Code Requirements for Reinforced Concrete.
  - i. ACI 347R: Recommended Practice for Concrete Formwork.
  - j. ACI SP-66: Detailing Manual.
- 3. American Welding Society (AWS): AWS D1.4 - Structural Welding Code - Reinforcing Steel.
  - 4. California Building Code (CBC) 2013, Chapter 19A, for concrete requirements.
  - 5. Concrete Reinforcing Steel Institute (CRSI): Manual of Standard Practice.
  - 6. National Ready Mixed Concrete Association (NRMCA): Check List for Certification of Ready Mix Concrete Production Facilities.
- I. Testing: Refer to Section 01 45 29 – TESTING LABORATORY SERVICES.

#### 1.4 GUARANTEE

- A. Provide in required form for a period of 2 years from date of acceptance by Owner.
- B. **Provide composite detectable warning panels warranty on manufacturer's form that products are to be free from defects in materials and workmanship for 5 years beginning at date of acceptance by Owner.**

#### 1.5 DELIVERY

- A. Deliver undamaged products to job in manufacturer's sealed containers and original bundles with tags and labels intact.

### PART 2 - PRODUCTS

#### 2.1 FORMWORK

- A. Forms:
  - 1. Lumber: Construction grade Douglas Fir. Hand select at exposed finishes to produce smooth, true surfaces.
  - 2. Plywood: APA B-B Plyform, Class 1 or better, mill oiled and edge sealed; thickness as required to achieve true plane surfaces with forming system used, minimum 5/8 inch thickness.
- B. Fasteners: As required; of sufficient strength and character to maintain formwork in place while placing concrete.
- C. Form Release Agent: Colorless mineral oil which will not stain the concrete or impair natural bonding characteristics of coating intended for use on concrete.

## 2.2 VAPOR BARRIER

- A. General: 10 mil polyethylene sheeting.
- B. Joint Tape: As recommended by manufacturer.

## 2.3 REINFORCEMENT

- A. Reinforcement Bars: ASTM A615, deformed; Grade 60 unless noted otherwise. ASTM A706 for all bars to be welded and where shown.
- B. Reinforcing Supports:
  - 1. General: Metal chairs, bolsters, bar supports, or spacers, sized and shaped for strength and support during concrete placement.
  - 2. Footings: Bottom bars supported with concrete blocks.
- C. Tie Wire: 16 gage annealed type.

## 2.4 ANCHOR BOLTS

- A. ASTM A307; rolled body bolts with upset threads not permitted.

## 2.5 TIE WIRE

- A. 16 gage annealed type.

## 2.6 CONCRETE

- A. Cement: Portland cement; ASTM C150, Type I or II, per ACI 318 Section 3.2
- B. Aggregates:
  - 1. General: ASTM C33, except as modified by this Section and per CBC Section 1903A.3.
  - 2. Lightweight: ASTM C330.
- C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials; CBC Section 1903A.4.
- D. Admixtures:
  - 1. Water Reducing and Retarding Admixture: ASTM C494, type D.
  - 2. Water Reducing Admixture (cool weather): ASTM C494, type A.
  - 3. Mid-range Water Reducing Admixture: Master Builders "Polyheed" or approved equal.
  - 4. Air Entrainment Admixture: ASTM C260.
  - 5. Fly Ash: ASTM C618, Class N or F. Class C not permitted.
    - a. Use water vapor emission system selected by Owner. Only use Moxie if Owner requests it. Moxie 1800 is a liquid admixture. Do not use Moxie with other water vapor emission control

**2.7 BONDING AGENT FOR PATCHING**

- A. Acceptable Products: Acryl 60, as manufactured by Master Builders Technologies, Inc.

**2.8 NON-SHRINK GROUT**

- A. Per ASTM C-1107, consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

**2.9 EXPANSION JOINT MATERIALS**

- A. Expansion Joint in Concrete (EJ-C): ASTM D 1751, preformed; 3/8 inch thick, unless otherwise shown.
- B. Removable Expansion Joint Cap:
  - 1. Acceptable Products:
    - a. Sandell's Removable Expansion Joint Cap, as manufactured by Sandell Construction Solutions.
    - b. Snap-Cap, as manufactured by W. R. Meadows, Inc.
    - c. Model No. EXPJ-006, as manufactured by Right/Pointe Company.
  - 2. Alternate Products: Proposed equals are subject to substitution process per Section 01 33 00 – PRODUCT SUBMITTALS AND SUBSTITUTIONS.
  - 3. Use at expansion joints in pavement and other horizontal surfaces
  - 4. Size: 3/8 inch wide, depth of concrete.

**2.10 SEALANT FOR JOINTS AND CRACKS**

- A. Acceptable Products: Sikaflex-2c NS, as manufactured by Sika Corp; two component polyurethane, or per vapor control manufacturer's recommendation.

**2.11 DESIGN AND MIXING**

- A. Mix Designs:
  - 1. Mix designs shall be prepared at contractor's expense by a registered civil engineer experienced in concrete mix design in accordance with CBC Section Chapter 19A. Identify mixes by design strength, intended use, and placement restrictions, such as "pump mix" or "hot weather mix".
  - 2. Concrete at Buildings: 3,000 psi concrete at floor slab patches.
  - 3. Concrete slabs which will receive adhered finish flooring shall have a maximum water cement ratio of 0.50.
  - 4. Site Concrete: 3000 psi at 28 days; 1 inch maximum aggregate size; 0.50 maximum water to cement ratio. Exposed concrete to have 4% air entrainment maximum.
  - 5. Slump:
    - a. Footings and Retaining Walls: 3 inches plus or minus 1 inch.

- b. Flatwork: 4 inches plus or minus 1 inch. Exception: mixes using mid-range water reducing admixture shall have a 2 inch maximum slump before dosing and 6 inches maximum slump after dosing.
- 6. Water Reducing Admixture: Water reducing and retarding admixture (type D) is required for all concrete to be placed on days when the daily high temperature is expected to exceed 80 degrees Fahrenheit. Water reducing admixture (type A) may be substituted in mixes to be placed on cooler days.
- 7. Fly Ash: Not to exceed 15% of the total cementitious material.
- 8. Carbon Black Coloring: Tone down exterior concrete slabs, walks, ramps, stairs (including bleachers) and other exposed flatwork to eliminate glare, using dispersed carbon black in liquid form at rate of not more than 3 pounds per cubic yard of concrete. Exact amount used will depend on color of cement, and shall be as directed. Add color to mix in accord with manufacturer's printed instructions.

**B. Mixing of Concrete:**

- 1. General: Concrete shall be transit mixed per CBC Chapter 19A and ASTM C94. Mix until there is uniform distribution of material and mass is uniform and homogeneous; mixer must be discharged completely before the mixer is recharged.
- 2. Ready-Mix Concrete: Mix and deliver in accordance with the requirements set forth in CBC Section 1904A.2 and ACI 318. Batch Plant Inspection may be waived in accordance with CBC Section 1705A.3.3 when approved by Civil Engineer and the Division of the State Architect.
  - a. Approved inspector of the testing laboratory shall check the first batching at the start of the work and furnish mix proportions to the licensed Weighmaster.
  - b. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
  - c. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit 2 copies of record to authority having jurisdiction.
  - d. A minimum of 1 set of 2 cylinders shall be taken and tested for each 50 cubic yards of concrete or fraction thereof.
- 3. Admixtures: Verify compatibility of concrete admixtures when multiple admixtures are used in a specific mix. Proportion and mix in accordance with manufacturers written instructions.
- 4. Job Mixed Concrete:
  - a. General: Not allowed without prior approval of Architect. Use batch mixer of approved type, with capacity to handle one or more full sack batches, no split sack batches permitted. Operate as recommended by manufacturer, mixing at least 1-1/2 minutes after all materials are in drum.
  - b. Handling and Mixing of Concrete: Subject to approval of inspector and architect.

**2.12 COMPOSITE DETECTABLE WARNING PANELS**

**A. Acceptable Manufacturers:**

- 1. ADA Solutions, Inc.



- 2. Access Tile, Access Products Inc.
- B. Alternate Manufacturers: Proposed equals are subject to substitution process per Section 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- C. Panel System: Cast in place replaceable with 1-1/2 inch depth.
- D. Nominal Size: Manufacturer's largest standard size to suit project; sections less than 36 inches in any direction are not acceptable, unless noted otherwise.
- E. Color: Yellow conforming to FS 33583 of Federal Standard 595C. Color shall be integrally mixed with warning surface. Surface applied color onto warning surface is not allowed.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Notify Architect and Structural Engineer at least 48 hours prior to placing of concrete.
- B. Environmental Requirements: Per ACI 305R and ACI 306R.
- C. Take field measurements; report variance between plan and field dimensions.
- D. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness; lumpy or stale cement will be rejected.
- E. Protect finish surfaces adjacent to locations scheduled for placement of concrete. Inspect forming placed against existing work and establish a tight, leak-proof seal before concrete is poured. Replace finish work defaced by concrete placement operations.

### **3.3 INSTALLATION**

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Install to allow application of subsequent finish materials within specified tolerances.
- C. Formwork:
  - 1. General:
    - a. Workmanship: Provide formwork required to produce smooth concrete; straight, plumb and true to plane. Concrete out of line, level or plumb will be rejected.
    - b. Material: Provide straight, true and sound form material, able to withstand deformation due to loading and the effects of moist curing. Do not reuse warped or delaminated materials that require patching of contact surfaces.
    - c. Construction: Construct forms to shapes, lines, grades and dimensions indicated; tight to prevent leakage, properly braced and tied together to maintain position and shape. Form bevels, grooves and recesses to neat, straight lines; chamfer corners where indicated. Provide for easy removal without hammering, wedging or prying against concrete.

- d. Adjustment: Tighten forms, posts and shores during and immediately after concrete placement; readjust as required to maintain grades, levels and camber.
  - e. Exposed Finish: At vertical surfaces exposed to view and other conditions where formed surface will be visible, formwork shall be crafted to produce finished concrete without further work such as sacking or patching. Finish shall be is smooth, true to plane, uniform in appearance, and free irregularities and defects at time of stripping. Small air pockets less than ¼ inch in diameter will not be considered defective. Vertical Surfaces: Provide formwork required to produce finished concrete that is smooth, true to plane, uniform appearance, and free irregularities and defects at time of stripping. Small air pockets less than ¼" in diameter will not be considered a defect.
2. Embedded Components:
- a. General: Install straight, level and plumb prior to concrete placement; brace, anchor and support items to prevent displacement or distortion.
  - b. Inserts: Coordinate work of other Sections in setting bolts, anchors, and other components, as required.
  - c. Formed Openings: Provide slots, recesses, chases and sleeves where required for work to be imbedded in or pass through concrete.
3. Anchor Bolts: Install as shown.
4. Form Coating:
- a. General: Before placement of reinforcing steel, coat exposed face of forms to prevent moisture absorption from concrete and facilitate removal of forms; seal all cut edges.
  - b. Re-use: Thoroughly clean and recoat form material acceptable for re-use.
- D. Reinforcement:
- 1. Fabrication: Do not bend or straighten reinforcement in manner that will injure material. Bars with kinks or bends not shown, and heating of bars for bending is not permitted.
  - 2. Placement:
    - a. Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with CBC Section 1907A.7.
    - b. Provide minimum center to center distance between parallel bars 2-1/2 times diameter, 1-1/2 inches or 2-1/2 times maximum size coarse aggregate. Wire bar lap together; splice reinforcing steel with lap of 69 diameters, unless otherwise shown.
- E. Expansion Joints:
- a. Location: As shown. If not shown at exterior locations, place at 20 feet on center.
  - b. Flush Sealant: Unless noted otherwise, hold expansion joint material 1 inch back from finish surface. Provide sealant flush with finish surface.
  - c. Depressed Sealant: Where shown as drainage channel, depress expansion joint to provide ½ inch deep recess after sealant is applied.
- F. Cast-In-Place Concrete:

1. General: Placement of forms, inserts and reinforcements are subject to approval of Architect. Notify Architect and Structural Engineer at least 48 hours prior to placement of concrete.
2. Cleaning:
  - a. General: Remove dirt, wood chips, sawdust and other debris before concrete pour; use compressed air at inaccessible areas. Remove all water from excavations.
  - b. Reinforcing: Clean reinforcement and other embedded items of substances that might impair bonding, prior to placement of concrete.
  - c. Previously Placed Concrete: Roughen to 1/4 inch amplitude; clean with steel brush prior to applying bonding agent.
3. Vapor Barrier:
  - a. General: Install under interior slabs on grade. Lap joints minimum 6 inches and seal watertight.
  - b. Penetrations: Seal watertight; repair penetrations and damage with vapor barrier material and lapped minimum 6 inches over area and sealed with joint tape.
4. Placing of Concrete:
  - a. General: Maintain records for placement of all concrete. Place concrete in dry conditions; keep excavations free of water, ice, loose soil or debris.
  - b. Weather Requirements: Per ACI 305R (Hot) and ACI 306R (Cold). Hot weather is defined as any period in which temperature exceeds 85 degrees F.
  - c. Transportation: Handle concrete from mixer to place of deposit as rapidly as possible; using methods to prevent separation or loss of ingredients. Deposit in final position; avoid rehandling or flowing. Do not place partially hardened concrete in work. Do not wheel placement containers directly on top of reinforcing steel.
  - d. Placement:
    - i. General: Place concrete continuously between predetermined expansion, control and construction joints. Do not break or interrupt placement of concrete in manner that cause cold joints to occur.
    - ii. Footings: Place footings in one continuous pour.
    - iii. Concrete Slabs: Lay slabs to required lines and grades, in pattern shown. Water subgrade at exterior concrete the night before placement; dampen again immediately before placement; standing water not allowed.
5. Compacting:
  - a. General: Thoroughly work concrete around reinforcement, embedded components and into corners of forms. Consolidate concrete by internal vibration, only. Do not puddle, tamp or vibrate concrete which has already taken initial set or continue long enough cause segregation of material.
  - b. Slabs: Consolidate concrete on grade by spading and puddling and internal vibration.
  - c. Formwork: Consolidate concrete in forms with high speed internal vibrators.
6. Flatness:

- a. Typical Interior Slabs: True to 1/8 inch in 10 feet when measured with a 10 foot straight edge. Slabs to receive finish flooring may be patched with approved hydraulic cement to required flatness. Polished concrete floors and other exposed concrete floors shall be removed and replaced if they do not meet the flatness requirements per ASTM E1155.
  - b. Exterior Slabs: as required to avoid "bird baths" and meet accessibility maximum slopes; true to maximum 1/8 inch in 10 feet.
7. Concrete Finishes:
- a. Slab Finish:
    - i. General: Uniformly spread, screed and float concrete.
    - ii. Float: Apply at tile setting beds, where shown.
    - iii. Trowel: Apply 2 steel troweling operations at surfaces to receive carpet, resilient materials, thinset tile and where left exposed. Finish interior exposed concrete to achieve burnished surface.
    - iv. Broom (BRF): Apply medium broom finish at exterior exposed surfaces, perpendicular to direction of traffic flow. Apply medium broom finish at slopes less than 5% at the designated path of travel; apply heavy broom finish at slopes greater than 5%.
  - b. Vertical Surfaces:
    - i. Vertical Formed (VF): Vertical surfaces and other formed surfaces permanently exposed to view after stripping shall be smooth, uniform and free of defects without additional finish work after stripping. Minor sacking and repair work will be allowed only if it blends with the adjacent finish and is not visually distinguishable.
  - c. Vertical Troweled (VT): Curbs adjacent to pavement and vertical surfaces requiring troweled finish shall be stripped at the appropriate time and troweled to a burnished finish to match adjacent or nearest slab finish and shall be true to line with a maximum tolerance of 1/8 in 10 feet.
8. Joints:
- a. Exterior Joints: Mark off exposed joints, where indicated, with 1/2 inch radius by 1 1/2 inch deep joint tool. Markings to be clean cut, straight and square with respect to border. Tool edges of exposed expansion and control joints, border edges, and wherever concrete adjoins other material or vertical surfaces.
  - b. Interior Joints: Joints in concrete to be left exposed shall be made with a 1/4 inch radius by 1 1/2 inch deep joint tool. Saw cut joints at interior slabs to receive flooring only. Saw cut joints as soon as slab will support foot traffic. Complete all saw cutting as part of finishing operation.
  - c. Horizontal Construction Joints: Keep exposed concrete face of construction joints continuously moist after initial set until placement of concrete; thoroughly clean contact surface by exposing solidly embedded aggregate, or by other method that will assure proper bonding.
9. Curing:
- a. General: Refer to ACI 308. Protect concrete from premature drying for minimum 5 days following pour.
  - b. Exterior Slabs: Cover and cure with membrane curing compound as soon as slab can take foot traffic, or approved method; upon completion wash clean.

- c. Interior Slabs: Cure with curing compound as soon as slab can take foot traffic (after any saw cutting).
  - d. Concrete in Forms: Keep wet until forms are stripped.
- 10. Removal of Forms: Remove without damage to concrete surfaces.
  - a. Sequence and timing of form removal shall insure complete safety of concrete structure.
  - b. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
    - i. Vertical Forms of Foundations, Walls and All Other Forms Not Covered Below: 7 days.
    - ii. Slab Edge Screens or Forms: 5 days.
    - iii. Concrete Columns and Beams: 14 days.
- 11. Sealant: Fill all interior slab joints with sealant. Fill all expansion joints with sealant. Fill all cracks in areas to receive adhered flooring with sealant.
- 12. Defective Concrete:
  - a. General: Remove or cut out defective concrete and repair before concrete is completely cured, as directed by Architect.
  - b. Defective Concrete is:
    - i. General: Concrete not meeting specified 28-day strength.
    - ii. Finish: Concrete not matching the specified finish.
    - iii. Durability and Appearance: Concrete containing rock pockets, voids, spalls, cracks, exposed reinforcing, or other defects.
    - iv. Construction: Concrete out of line, level, flatness, plumb, or location.
    - v. Deleterious Materials: Concrete containing embedded wood or other debris.
    - vi. Unsatisfactory Patching: Concrete that was not patched under Architect's direction or patching that does not meet the specification for new concrete.
    - vii. Embedded Items: Concrete not containing required embedded items.
  - c. Patching:
    - i. General: Repair minor defective work with approved patching material.
    - ii. Patching of serious defects affecting the strength or appearance of the concrete are unsatisfactory, will not be accepted and shall be completely removed and replaced.
    - iii. Preparation: Chip out minor defective areas to a minimum depth of 1 inch, with edges perpendicular to surface. Wet area at least 6 inches around surface to be patched to prevent absorption of water from patching mortar.
    - iv. Repair: Coat with cement wash mix consisting of neat cement and solution of specified bonding agent. Immediately apply patching mortar consisting of 1 part cement to 3 parts fine aggregate mixed with solution with minimum water required for placement.
    - v. Finishing: Match adjoining surfaces; provide protective covering; keep wet for at least 7 days.

### 3.4 COMPOSITE DETECTABLE **WARNING** PANELS

- A. Set panels in wet concrete.
- B. Concrete shall be finished level, true and smooth to the required dimensions prior to placement of panels; mechanically fastened panels are not acceptable unless noted otherwise.
- C. Work in a grid pattern and install panels in largest size possible with minimal cutting of panels. Sections less than 36 inches in any direction are not acceptable. Tamp panels with rubber mallet and wood to release air. Avoid striking the surface directly. ]
- D. Place an 8 x 8 x 16 inch concrete masonry unit or similar weight item on both ends of panels until concrete has set.

### 3.5 FIELD QUALITY CONTROL

- A. General: Per CBC, Section 1704A; agency selected and paid for by Owner.
- B. Field Testing:
  - 1. General: The following testing will be performed by the **[Project Inspector]** or the Owner's testing lab in accordance with ASTM procedures. Test cylinders are to be provided by the contractor.
  - 2. Cylinders: Make, cure, and store 1 set of 3 cylinders, for each 50 cubic yards (or not less than once for each 2,000 square feet of surface area for slabs or walls) of each concrete mix being placed not less than once per day per ASTM C31. Test cylinders per ASTM C39. Test first cylinder at the age of 7 days and the other at 28 days; cylinder for 28-day test will not be broken if cylinder for 7-day test meets 28-day strength. Hold third cylinder for 56 day test, if required. Additional samples for 7-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.
  - 3. Slump: Perform one slump test, per ASTM C143, for each 15 cubic yards of concrete placed and for each cylinder taken.
  - 4. Reinforcement: Make 1 tensile test and 1 bend test of specimen taken from each 10 tons of steel delivered to the site.
- C. Retesting: Cost of retests or coring because of low strength, or defective concrete will be paid for by Owner and deducted from the contract cost

### 3.6 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.

END SECTION 03 30 00



**PART 1 - GENERAL****1.1 SUMMARY**

- A. Table of Contents, Division 26 - Electrical:

<u>SECTION NO.</u>	<u>SECTION TITLE</u>
260010	BASIC ELECTRICAL REQUIREMENTS
260531	CONDUIT
260533	BOXES
260553	ELECTRICAL IDENTIFICATION

- B. Work included: This Section includes general administrative and procedural requirements for Division 26. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 01.

1. Quality assurance.
2. Definition of terms.
3. Submittals.
4. Coordination.
5. Record documents.
6. Operation and maintenance manuals.
7. Rough-in.
8. Electrical installation.
9. Cutting, patching, painting and sealing.
10. Field quality control.
11. Cleaning.
12. Project closeout.

- C. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete and operable installation.

1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26 Sections.
2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, lighting pole foundations, etc. Refer to Division 31, Earthwork.
3. Selective demolition: Nondestructive removal of materials and equipment for reuse or salvage as indicated. Also dismantling electrical materials and equipment made obsolete by these installations. Refer to Division 02, Selective Demolition.



## BASIC ELECTRICAL REQUIREMENTS - SECTION 26 00 10

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4. Concrete Work: Include forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting as required for under ground conduit encasement, light pole foundations, pull box slabs, vaults, housekeeping pads, etc. Refer to Division 03, Concrete.
5. Miscellaneous metal Work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor control centers, etc. Refer to Division 05, Miscellaneous Metals.
6. Miscellaneous lumber and framing Work: Include wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment. Refer to Division 06, Rough Carpentry.
7. Moisture protection and smoke barrier penetrations: Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vaportight. Refer to Division 07, Thermal and Moisture Protection.
8. Access panels and doors: Required in walls, ceilings and floors to provide access to electrical devices and equipment. Refer to Division 08, Access Doors also, Division 05, Metals.
9. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 09, Painting.
10. Lighting fixture supports: Provide slack fixture support wire for lighting fixtures installed in acoustical tile or lay-in suspended ceilings. Refer to Division 09, Acoustical Treatment.

### 1.2 QUALITY ASSURANCE

- A. Reference to Codes, Standards, Specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.
- B. When codes, standards, regulations, etc. allow Work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements or extent of the Contract Documents. The Contract Documents address the minimum requirements for construction.
- C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
  1. California Electric Code (CEC)
  2. California Building Code (CBC).
  3. California Fire Code (CFC).
  4. California Mechanical Code (CMC).
- D. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
CBM	Certified Ballast Manufacturers
ETL	Electrical Testing Laboratories

FS	Federal Specification
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IPCEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturer's Association
UL	Underwriters' Laboratories

### 1.3 DEFINITION OF TERMS

A. The following list of terms as used in the Division 26 documents shall be defined as follows:

1. "Provide": Shall mean furnish, install and connect unless otherwise indicated.
2. "Furnish": Shall mean purchase and deliver to Project site.
3. "Install": Shall mean to physically install the items in-place.
4. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.
5. "As directed": Shall be as directed by the Owner or their authorized Representative.
6. "Utility Companies": Shall mean the company providing electrical, telephone or cable television services to the Project.

### 1.4 COORDINATION

A. Discrepancies:

1. In the event of discrepancies within the Contract Documents, the Engineer shall be so notified, within sufficient time, as delineated in Division 01, prior to the Bid Opening to allow the issuance of an Addendum.
2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The Drawings govern in matters of quantity and the Specifications govern in matters of quality. In the event of conflict within the Drawings involving quantities or within the Specifications involving quantities or within the Specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Contractor's Bid. No additional allowances will be made because of errors, ambiguities or omissions that reasonably should have been discovered during the preparation of the Bid.

B. Project conditions:

1. Examination of Project site: The Contractor shall visit the Project site and thoroughly review the locale, working conditions, conflicting utilities and the conditions in which the Electrical Work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the Project site and to notify the Engineer of any discrepancies between Contract Documents and actual Project site conditions.
2. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.

3. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the Work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

**C. Preparation:**

**1. Drawings:**

- a. Layout: General layout indicated on the Drawings shall be followed except where other Work may conflict with the Drawings.
- b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.

**1.5 RECORD DOCUMENTS**

**A. Provide Project Record Drawings as described herein:**

1. Drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit and wire sizing as well as routing, revised fixture schedule listing Manufacturers and products actually installed and revised panel schedules. Contractor shall record all changes in the Work during the course of construction on blue or black line prints. These prints shall be made subject of monthly review by the Owner's Representative to ascertain that they are current. If not current monthly payments may be withheld.
2. Record drawing submissions shall be provided to the Engineer to review upon the completion of the following phases of Work:
  - a. Final electrical installation.
3. A single set of half size prints of the Record Drawings shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made and the Contractor shall provide the following:
  - a. Two sets of full size prints.
  - b. One flash drive or DVD with electronic copies of the record drawings in PDF and AutoCAD Release 2012 file formats.

**B. Panel schedules:**

1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms provided by the Manufacturer and inserted in the pocket of the inner door of each panelboard. See Section 262416: Panelboards for requirements.

**PART 2 - PRODUCTS (NOT APPLICABLE)**

**PART 3 - EXECUTION**

**3.1 ROUGH-IN**

- A. Contractor shall verify lines, levels and dimensions indicated on the Drawings and shall be responsible for the accuracy of the setting out of Work and for its strict conformance with existing conditions at the Project site.
- B. Verify final locations for rough-ins with field measurements and with the requirements for the actual equipment to be connected.

**3.2 ELECTRICAL INSTALLATION**

- A. Preparation, sequencing, handling and installation shall be in accordance with Manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:
1. Verify all dimensions by field measurements.
  2. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installations.
  3. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  4. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
  5. Where mounting height is not detailed or dimensioned, contact the Architect for direction prior to proceeding with rough-in.
  6. Install systems, materials and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are indicated only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
  7. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
  8. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
  9. Coordinate electrical systems, equipment and materials installations with other building components.
  10. Provide access panel or doors where devices or equipment are concealed behind finished surfaces. Furnish and install access doors per the requirements of Division 08.
  11. Install systems, materials and equipment giving right-of-way priority to other systems that are required to maintain a specified slope.
  12. Conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

### **3.3 CUTTING, PATCHING, PAINTING AND SEALING**

- A. Structural members shall in no case be drilled, bored or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Architect and Structural Engineer.
- B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- C. Cut, remove and legally dispose of selected electrical equipment, components and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.

- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- F. Patch existing surfaces and building components using experienced installers and new materials matching existing materials and the original installation. For installers' qualifications refer to the materials and methods required for the surface and building components being patched.
- G. Application of joint sealers:
  - 1. General: Comply with joint sealer Manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
  - 2. Installation of fire-stopping sealant: Install sealant, including forming, packing and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops and fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

### **3.4 FIELD QUALITY CONTROL**

- A. General testing requirements:
  - 1. The purpose of testing is to ensure that all tested electrical equipment, both Contractor and Owner supplied, is operational and within industry and Manufacturer's tolerances and is installed in accordance with design Specifications.
  - 2. Tests and inspections shall determine suitability for energization.
  - 3. Perform tests in presence of the Owner's Representative and furnish test equipment, facilities and technical personnel required to perform tests.
  - 4. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.
- B. Tests: In addition to specific system test described elsewhere, tests shall include:
  - 1. Equipment operations: Test motors for correct operation and rotation.
  - 2. Lighting control circuits: Test lighting circuits for correct operation through their control devices.
  - 3. Alarm and interlock systems: Produce malfunction symptoms in operating systems to test alarm and interlock systems. In addition, all specific tests described in the fire alarm/life safety system shall be performed.
  - 4. Circuit numbering verification: Select on a random basis various circuit breakers in the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.
  - 5. Voltage check:
    - a. At completion of job, check voltage at several points of utilization on the system that has been installed under this Contract. During test, energize all installed loads.
    - b. Adjust taps on transformers to give proper voltage, which is 118 to 122 volts for 120 volt nominal systems and proportionately equivalent for higher voltage systems. If proper voltage cannot be obtained, inform the Owner and the serving Utility Company.
- C. Contractor shall provide test power required when testing equipment before service energization and coordinate availability of test power with General Contractor after service energization. The Contractor shall provide any specialized test power as needed or specified herein.
- D. Testing safety and precautions:

1. Safety practices shall include the following requirements:
    - a. Applicable State and Local safety operating procedures.
    - b. OSHA.
    - c. NSC.
    - d. NFPA 70E.
  2. All tests shall be performed with apparatus de-energized and grounded except where otherwise specifically required ungrounded by test procedure.
- E. Calibration of test equipment:
1. Testing Agency shall have calibration program that assures test instruments are maintained within rated accuracy.
  2. Instruments shall be calibrated in accordance with the following frequency schedule:
    - a. Field instruments: Analog, 6 month maximum; Digital, 12 months maximum.
    - b. Laboratory instruments: 12 months.
    - c. Leased specialty equipment: 12 months where accuracy is guaranteed by lessor.
  3. Dated calibration labels shall be visible on test equipment.
  4. Records, which show date and results of instruments calibrated or tested, must be kept up-to-date.
  5. Up-to-date instrument calibration instructions and procedures shall be maintained for test instrument.
  6. Calibration standards shall be of higher accuracy than instrument tested.
  7. Equipment used for field testing shall be more accurate than instrument being tested.
- F. Coordinate with General Contractor regarding testing schedule and availability of equipment ready for testing.
- G. Notify Owner and Engineer one week in advance of any testing.
- H. Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired or corrected as prescribed by the Owner's Representative at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.
- I. Testing Agency shall maintain written record of tests and shall assemble and certify final test report.
- J. Include all test results in the maintenance manuals.

### **3.5 CLEANING**

- A. Prior to energizing of electrical equipment, the Contractor shall thoroughly clean the interior of enclosures from construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.
- B. Upon completion of Project, prior to final acceptance, the Contractor shall thoroughly clean both the interior and exterior of all electrical equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt and debris.
- C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

END OF SECTION 26 00 10



**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
  - 1. Rigid non-metallic conduit and fittings.
  - 2. Flexible metallic conduit and fittings.
  - 3. Liquidtight flexible metallic conduit and fittings.
  - 4. Miscellaneous conduit fittings and products.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
  - 1. Division 01: Cutting and patching.
  - 2. Division 31: Earthwork. Excavation and backfill for conduit and utilities on Project site.
  - 3. Division 07: Sheet metal flashing and trim.
  - 4. Division 09: Painting. Exposed conduit and other devices.

**1.2 REFERENCES**

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
  - 1. Federal Specifications (FS):
    - FS WW-C-563;               Electrical Metallic Tubing.
    - FS WW-C-566;               Specification for Flexible Metal Conduit.
    - FS WW-C-581;               Specification for Galvanized Rigid Conduit.
    - FS W-C-1094A;             Conduit and Conduit Fittings Plastic, Rigid.
  - 2. American National Standards Institute, Inc. (ANSI):
    - ANSI C80.1;                Rigid Steel Conduit, Zinc-Coated.
    - ANSI C80.3;                Electrical Metallic Tubing, Zinc Coated.
  - 3. Underwriters Laboratories, Inc. (UL):
    - UL 1;                       Flexible Metal Conduit.
    - UL 6;                       Rigid Metal Conduit.
    - UL 360;                    Liquid-Tight Flexible Steel Conduit.
    - UL 514B;                  Conduit, Tubing and Cable Fittings.
    - UL 635;                    Insulating Bushings.
    - UL 651;                    Schedule 40 and 80 Rigid PVC Conduit.



UL 651A;                      Type EB and A Rigid PVC Conduit and HDPE Conduit.

UL 797;                      Electrical Metallic Tubing - Steel.

UL 1242;                    Intermediate Metal Conduit - Steel.

4. National Electrical Manufacturer Association (NEMA):

NEMA RN1;                PVC Externally coated Galvanized Rigid Steel Conduit.

NEMA TC 2;                Electrical Plastic Tubing and Conduit.

NEMA TC 3;                PVC Fittings for use with Rigid PVC Conduit.

NEMA TC 6;                PVC Plastic Utilities Duct (EB and DB Type)

NEMA TC 9;                Fittings for PVC Plastic Utilities Duct (EB and DB Type)

**1.3 SUBMITTALS**

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instruction. Provide written instructions for raceway products requiring glues, special tools or specific installation techniques.

**1.4 QUALITY ASSURANCE**

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Metal conduit:
  - a. Allied Tube and Conduit Co.
  - b. Triangle PWC, Inc.
  - c. Western Tube and Conduit Corp.
  - d. Spring City Electrical Manufacturing Co.
  - e. Occidental Coating Co. (OCAL).
  - f. Alflex Corp.
  - g. American Flexible Metal Conduit Co.
  - h. Anaconda.
2. Nonmetallic conduit:

- a. Carlon.
- b. PW Pipe.
- 3. Fittings:
  - a. Appleton Electric Co.
  - b. OZ/Gedney.
  - c. Thomas & Betts Corp.
  - d. Spring City Electrical Manufacturing Co.
  - e. Occidental Coating Co. (OCAL).
  - f. Carlon.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

## **2.2 GALVANIZED RIGID STEEL CONDUIT (GRS)**

- A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.
- B. Standard threaded couplings, locknuts, bushings and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.
- C. Three piece couplings: Electroplated, cast malleable iron.
- D. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150 degree C minimum.
- E. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
- F. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150 degrees C.
- G. All fittings and connectors shall be threaded.

## **2.3 PVC INSULATED GALVANIZED RIGID STEEL CONDUIT (PVC GRS)**

- A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
- B. Fittings: Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.

## **2.4 INTERMEDIATE METAL CONDUIT (IMC)**

- A. Conduit: Hot dip galvanized steel meeting the requirements of NEC Article 345 and conforming to ANSI C80.6 and UL 1242.
- B. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

## **2.5 ELECTRICAL METALLIC TUBING (EMT)**

- A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.

- B. Set screw type couplings: Electroplated, steel or cast malleable iron, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
- C. Set screw type connectors: Electroplated steel or cast malleable iron UL listed concrete tight with male hub and insulated plastic throat, 150 degree C temperature rated. Setscrew shall be same as for couplings.
- D. Raintight couplings: Electroplate steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.
- E. Raintight connectors: Electroplated steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.

**2.6 RIGID NON-METALLIC CONDUIT (PVC)**

- A. Conduit:
  - 1. Rigid polyvinyl chloride, Schedule 40 or 80 conforming to NEMA TC1 and UL 651, latest edition. UL listed for exposed and direct-burial applications and for 90 degrees C conductor insulation. Conduit shall include an integral bell fitting at one end.
  - 2. Rigid polyvinyl chloride, Type EB or DB conforming to NEMA TC 6 and UL 651, latest edition. UL listed for concrete encased burial and direct burial applications and for 90 degrees C conductor insulation. Conduit shall include an integral bell fitting at one end.
- B. Fittings: Couplings, adaptors, transition fittings, etc., shall be molded PVC, slip on, solvent weld type conforming to NEMA TC3 for Schedule 40 or 80 and NEMA TC 9 for type EB or DB.

**2.7 FLEXIBLE METALLIC CONDUIT (FMC)**

- A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1.
- B. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for fixture connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

**2.8 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)**

- A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.
- B. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

**2.9 RIGID NON-METALLIC CONDUIT (FRE)**

- A. Conduit: Rigid fiberglass reinforced epoxy composed of glass filaments encapsulated in an epoxy matrix. Each conduit length shall have an integral wound in expanded couplings. Size 2" through 6" shall incorporate an integral urethane gasket for sealing. No threads or adhesive shall be required to assemble the joints for in ground installations. All conduit and fittings will be pigmented with carbon black dispersed homogeneously throughout the epoxy glass matrix for U.V. protection.
- B. Conduit and fittings shall be filament wound.

- C. Conduit shall be suitable for continuous operation from -40°C to +110°C without significant change of mechanical properties. Conduit combustion by-products shall not contain chlorine gas in excess of trace levels and always less than OSHA limits.
- D. FRE conduit shall be designated so conductors shall not adhere to conduit or fittings in fault conditions.
- E. Dimensions: Conduit and fittings in 2" through 6" sizes inclusive shall have inside diameter equal to the trade size.

## **2.10 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS**

- A. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.
- B. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.
- C. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.
- D. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate .75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless steel jacket clamps. Unit shall comply with UL467 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF or equal.
- E. Fire rated penetration seals:
  - 1. UL building materials directory classified.
  - 2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.
  - 3. The fire rated sealant material shall be the product best suited for each type of penetration and may be a caulk, putty, composite sheet or wrap/strip.
- F. Standard products not herein specified:
  - 1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.
  - 2. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
  - 3. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Contractor shall thoroughly examine Project site conditions for acceptance of conduit system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

### **3.2 APPLICATION**

- A. Galvanized rigid steel conduit (GRS) shall be used in the following applications:
  - 1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks or in hazardous locations in accordance with NEC and local Codes.
  - 2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.
- B. PVC insulated galvanized rigid steel conduit shall be used in the following applications:
  - 1. Use 40-mil coating for feeders and branch circuits in damp or wet locations.
  - 2. Use 20 or 40 mil for feeders and branch circuits concealed in concrete walls or slabs in contact with earth.
  - 3. Use 20 or 40-mil for runs beneath floor slabs on grade.
  - 4. Use 40-mil for all below grade penetrations through floor slabs on grade or exterior walls.
- C. Intermediate metal conduit (IMC): Shall be used for the same application as galvanized rigid steel conduit as specified herein.
- D. Electrical metallic tubing (EMT): Shall be used exposed or concealed for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension distribution system where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces. EMT shall not be installed exposed below 6 feet above the finish floor except within electrical, communication or signal rooms or closets.
- E. Rigid non-metallic conduit (PVC): Shall be used in the following applications:
  - 1. Schedule 40 or 80 for feeders and branch circuits run beneath ground floor slab except that bends and penetrations through the floor must be PVC coated galvanized rigid steel.
  - 2. Schedule 40 or 80 for exterior branch circuits directly buried in earth, 18" minimum below grade. PVC may be used below exterior slabs not subject to vehicular traffic.
  - 3. PVC may be used below exterior slab subjects to vehicular traffic when encased in a minimum of 2 inches of concrete.
  - 4. Only schedule 80 PVC may be used for above ground conduit extensions on utility poles.
  - 5. PVC elbows shall be radius sweep type schedule 40 for bends 45° or less and large radius sweep type schedule 80 for bends 46° or greater.
  - 6. In general, PVC may not be run exposed in concrete walls or in floor slabs unless expressly indicated on the Drawings.
  - 7. EB or DB type may be installed in lieu of the above only if encased in a minimum of 2 inches of concrete.
  - 8. Serving utility electrical and telephone and cable television service entrance conduits may be EB or DB type conduit only if acceptable by serving utility. Coordinate in field prior to installation.
- F. Flexible metallic conduit (FMC): Shall be used only in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices and to lighting fixtures installed in suspended ceilings, minimum sizes shall be 3/8" for lighting fixtures and control wiring and 1/2" for motor and transformer connections. U.O.N.

- G. Liquidtight flexible metallic conduit (LFMC): Shall be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc. Minimum sizes shall be 1/2".
- H. Rigid non-metallic conduit (FRE): Shall be used for direct burial, concrete encasement and for bridge applications whether suspended or encased; except in hazardous location, where indicated on Contract Drawings or by these Specification.

### 3.3 PREPARATION

- A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
- B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.
- C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.
- D. Conduits shall not be placed closer than 12 inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.
- E. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.
- F. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center of concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.
- G. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150 feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.
- H. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated or specified in the Contract Documents or not.
- I. Connect recessed lighting fixtures to conduit runs with maximum six feet of flexible metal conduit or MC cable extending from a junction box to the fixture or manufactured wiring system.

### 3.4 INSTALLATION

- A. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Minimum Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1/2" for interior applications and 3/4" for exterior and underground applications.
- C. All conduit sizes indicated on the Drawings are sized for copper conductors with THHN/THWN insulation. If conductor type or size is changed the Contractor shall be responsible for resizing conduits upward to meet Code.
- D. In general, all conduit work shall be concealed where possible. Exceptions shall be electrical, communication and mechanical rooms, exposed ceiling areas, and parking garages.

- E. Conduit connections to motors and surface cabinets shall be concealed, with the exception of electrical, communication and mechanical rooms, or unless exposed Work is clearly called for on the Drawings.
- F. Install conduits in complete runs before pulling in cables or wires.
- G. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.
- H. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.
- I. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading. Coat all field-threaded joints with UL approved conductive type compound to ensure low resistance ground continuity through conduit and to prevent seizing and corrosion.
- J. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.
- K. In all empty conduits or ducts, install a "True Tape" conduit measuring tape line to provide overall conduit length for determining length of cables/conductors for future use.
- L. Conduit systems shall be mechanically and electrically continuous throughout. Install code size, insulated, copper, green-grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not indicated on the Drawings. Refer to Section 260526: Grounding and Bonding.
- M. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).
- N. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.
- O. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360 degrees, total).

### **3.5 PENETRATIONS**

- A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:
  - 1. Where indicated on the Structural Drawings.
  - 2. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size and position of each penetration.
- B. Cutting or holes:
  - 1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
  - 2. Provide sleeves or "can outs" for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.
  - 3. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.
  - 4. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.
- C. Sealing:

1. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.
  2. Fire stop: Where conduits, wireways and other electrical raceways pass through fire rated partitions, walls, smoke partitions or floor; install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.
- D. Waterproofing: At floor, exterior wall and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 07: Sealants and Caulking.
1. Install specified watertight conduit entrance seals at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be PVC coated rigid galvanized steel.
  2. For roof penetrations furnish and install roof flashing, counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the Specifications.
  3. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.
  4. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

### **3.6 CONCEALED IN CONCRETE**

- A. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the conduits.
- B. Installation of conduit in structural concrete that is less than three inches thick is prohibited. Topping slabs, maintenance pads and curbs are exempted.
- C. Tie conduits to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.
- D. Where nonmetallic conduit or tubing is used, raceways must be converted to PVC coated rigid steel conduit before rising above floor.
- E. Make couplings and connections watertight.
- F. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- G. Provide schedule 40 non-metallic sleeve through concrete or masonry walls where aluminum conduit penetrations are required.

### **3.7 UNDERGROUND INSTALLATION**

- A. Perform trenching, backfilling and compaction operations as specified in Division 31: Trenching.
- B. Install service utility company underground conduits in strict conformance to each utility company's requirements. Obtain a copy of each utility company's installation guidelines prior to commencing Work.
- C. Tops of conduits shall be as follows unless otherwise noted:
- D. Not less than 18 inches below finished grade.



- E. Not less than 24 inches below roadways, paved parking lots, driveways or any surface subject to vehicular traffic.
- F. Not less than 4 inches below building floor slab for branch circuits. Major feeders and large signal conduits (2" and greater) at not less than 18 inches.
- G. Depth of service utility conduits shall conform to utility company requirements.
- H. Furnish and install specified underground conduit marker 12" above conduits in trenches with all buried conduits.

**3.8 TERMINATIONS AND JOINTS**

- A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.
- B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
- C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.
- D. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.
- E. Stub-up connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver operated threaded flush plugs with floor.
- F. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets or gutters inside the building. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.
- G. Raceway seal: Inject into wire filled raceways, a pre-formulated rigid 2 lbs. density polyurethane foam which expands a minimum 35 times it's original bulk. Foam shall have the physical properties of water vapor transmission of 1.2 to 3.0 perms; water absorption less than 2% by volume, fungus and bacterial resistant. Foam shall permanent seal against water, moisture, insects and rodents. Install raceway sealing foam at the following points:
  - 1. Where conduits enter buildings from below grade.
- H. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:
  - 1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.
  - 2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits

to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.

- I. Use short length (maximum of 6ft) of the appropriate FMC or LFMC conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters or noise transmission. Provide liquidtight flexible metal conduit for installation in exterior locations, moisture or humidity-laden atmosphere, corrosive atmosphere, water hose or spray wash-down operations and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with FMC or LFMC conduit.

### 3.9 SUPPORTS

- A. Provide supports for raceways as specified in Section 260529: Electrical Hangers and Supports.
- B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the NEC.
- C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.
- D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.
- E. Individual 1/2" and 3/4" conduits installed above suspended ceilings may be attached to the ceiling's hanger wire using spring steel support clips provided that not more than two conduits are attached to any single support wire.
- F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.
- G. Fasteners and supports in solid masonry and concrete:
  - 1. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. After concrete installation:
    - a. Steel expansion anchors not less than ¼ inch bolt size and not less than 1-1/8 inch embedment.
    - b. Power set fasteners not less than ¼ inch diameter with depth of penetration not less than three inches.
    - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- H. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.
- I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

END OF SECTION 26 05 31



## **PART 1 - GENERAL**

### **1.1 SUMMARY**

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
  - 1. Pull and junction boxes.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
  - 1. Division 08: Access doors. Wall and ceiling access doors.

### **1.2 REFERENCES**

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
  - 1. American National Standards Institute/National Electrical Manufacturer Association:  
NEMA 250;                      Enclosures for Electrical Equipment (1000 volts maximum).
  - 2. Underwriters Laboratories (UL):  
UL 50;                              Enclosures for Electrical Equipment.  
UL 1773;                          Termination Boxes.

### **1.3 SUBMITTALS**

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
  - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
  - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
  - 3. Submit Manufacturer's installation instructions.

### **1.4 QUALITY ASSURANCE**

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
  - 1. Precast concrete boxes:
    - a. Christy Concrete Products, Inc.

- b. Brooks Products, Inc.
- c. Forni Corp.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Contractor shall thoroughly examine Project site conditions for acceptance of box installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

#### **3.2 INSTALLATION**

- A. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Locate electrical boxes as indicated on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.
- C. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.
- D. Provide precast concrete boxes in exterior planting areas, walkways, roads etc.

END OF SECTION 26 05 33

**PART 1 - GENERAL****1.1 SUMMARY**

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
  - 1. Wire and cable identification.
  - 2. Buried electrical line warnings.
  - 3. Junction box identification.
  - 4. Inscribed device coverplates.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
  - 1. Division 09: Painting.

**1.2 SUBMITTALS**

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
  - 1. Data/catalog cuts for each product and component specified herein.
  - 2. Schedules for nameplates to be furnished.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
  - 1. Conduit and wire markers:
    - a. Thomas & Betts Corp.
    - b. Brady.
    - c. Griffolyn.
  - 2. Inscription Tape:
    - a. Kroy.
    - b. Merlin.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

**2.2 NAMEPLATES**

- A. Type NP: Engraved, plastic laminated labels, Signs and Instruction Plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20 square inches or 8 inches in length; 1/8 inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.
- B. Color and letter height as specified in Part 3: Execution.

**2.3 LEGEND PLATES**

## **ELECTRICAL IDENTIFICATION - SECTION 26 05 53**

### **Page 2**

- A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.
- B. Stamped characters to be paint filled.

### **2.4 BRASS TAGS**

- A. Type BT: Metal tags with die-stamped legend, punched for fastener.
- B. Dimensions: 2" diameter 19 gauge.

### **2.5 PANELBOARD DIRECTORIES (400 AMP OR LESS)**

- A. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.
- B. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left hand side and even numbered circuits down the right hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126).

### **2.6 WIRE AND TERMINAL MARKERS**

- A. Provide self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips. Blank markers shall be inscribed using the printer or pen recommended by Manufacturer for this purpose.

### **2.7 CONDUCTOR PHASE MARKERS**

- A. Colored vinyl plastic electrical tape, 3/4" wide, for identification of phase conductors. Scotch 35 Brand Tape or equal.

### **2.8 UNDERGROUND CONDUIT MARKER**

- A. 6-inch wide, yellow polyethylene tape, with continuous black imprinting reading "Caution - Buried Electric Line Below".

### **2.9 INSCRIBED DEVICE COVERPLATES**

- A. Coverplate material shall be as specified in Section 262726: Wiring Devices.
- B. Methods of inscription: (Unless otherwise noted)
  - 1. Type-on-tape:
    - a. Imprinted or thermal transfer characters onto tape lettering system.
    - b. Tape trimmer.
    - c. Matte finish spray-on clear coating.
  - 2. Engraving:
    - a. 1/8" high letters.
    - b. Paint filled letters finished in black.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

### 3.2 NAMEPLATES

- A. Installation:
  - 1. Degrease and clean surfaces to receive nameplates.
  - 2. Install nameplates parallel to equipment lines.
  - 3. Secure nameplates to equipment fronts using machine screws.
- B. Provide type 'NP' color coded nameplates that present, as applicable, the following information:
  - 1. Equipment or device designation.
  - 2. Amperage, KVA or horsepower rating, where applicable.
  - 3. Voltage or signal system name.
  - 4. Source of power or control.
- C. Nameplates for power system distribution equipment and devices are to be black.
- D. Nameplates for signal systems equipment and devices are to be black except as follows:
  - 1. Fire alarm and life safety - Red.
- E. Minimum letter height shall be as follows:
  - 1. For panelboards, switchboards, battery panels, etc.: ½ inch letters to identify equipment designation. Use ¼ inch letters to identify voltage, phase, wires, etc.
  - 2. For individual circuit breakers, switches and motor starters in panelboards, switchboards use 3/8-inch letters to identify equipment designation. Use 1/8-inch letters to identify all other.
  - 3. For individual mounted circuit breakers, disconnect switches, enclosed switches and motor starters use 3/8-inch letters to identify equipment designation. Use 1/8" letters to identify all other.
  - 4. For transformers use 1/2 inch letters to identify equipment designation. Use ¼ inch letters to identify primary and secondary voltages, etc.
  - 5. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8-inch letters to identify equipment designation.

### 3.3 LEGEND PLATES

- A. Provide panel-mounted operators devices such as pilot lights, reset buttons, "HAND-OFF-AUTO" switches, etc.

### 3.4 BRASS TAGS

- A. Provide type BT tags for individual ground conductors to exposed ground bus indicating connection i.e. "UFER", "Cold water bond", etc.
- B. Provide tags for all feeder cables in underground vaults and pull boxes.
- C. Provide tags for empty conduits in underground vault, pull boxes and stubs.

### 3.5 PANELBOARD DIRECTORIES (400 AMP OR LESS)

- A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.
- B. Verify room numbers or area designation with Project Manager.



- C. Mount panelboard directories in a minimum 6" x 8" metal frame under clear plastic cover inside every panelboard.

**3.6 WIRE AND CABLE IDENTIFICATION**

- A. Provide wire markers on each conductor in panelboards, pull boxes, outlet and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment Manufacturer's Shop Drawings for control wiring.
- B. Provide colored phase markers for conductors as noted in Section 260519: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

**3.7 UNDERGROUND CONDUIT MARKERS**

- A. During trench backfilling, for exterior underground power, signal and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

**3.8 JUNCTION BOX IDENTIFICATION**

- A. The cover of junction, pull and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

**3.9 INSCRIBED DEVICE COVERPLATE**

- A. General:
  - 1. Lettering type: Helvetica, 12 point or 1/8" high.
  - 2. Color of characters shall be black.
  - 3. Locate the top of the inscription 1/2" below the top edge of the coverplate.
  - 4. Inscription shall be centered and square with coverplate.
- B. Application:
  - 1. Provide inscribed coverplates for devices as outlined below:
    - a. Receptacles.
    - b. Outlets in surface raceways.
    - c. Multi-ganged (four or more) switch arrangement.
    - d. Special purpose switches, i.e. projection screens, shades, exhaust fans, etc.
    - e. Telecommunication outlets.
  - 2. Type-on-tape inscriptions shall be provided for the following devices:
    - a. Receptacles.
    - b. Outlets in surface raceways.
    - c. Telecommunication outlets.
    - d. Type-on-tape installation:

- 1) Tape shall be trimmed to the height of the letters.
  - 2) Trim tape length to 1/4 inch back from each edge of coverplate.
  - 3) Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.
3. Engraved inscriptions shall be provided for the following devices:
- a. Multi-ganged switches.
  - b. Special purpose switches.

END OF SECTION 26 05 53



### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes earthwork and related work as shown and specified.

#### **1.3 SUBMITTALS**

- A. Samples: If specifically requested.
- B. Test Reports: Refer to Section 01 45 29 - TESTING LABORATORY SERVICES

#### **1.4 QUALITY ASSURANCE**

- A. Reference Documents:
  - 1. Site Survey and Topographic Information: A site survey was made by Warren Consulting Engineers and is included in these documents as a reference. Included surveys are not part of the contract documents prepared by Architectural Nexus Architects. Verify locations of utilities and existing surface features prior to beginning construction. Notify Architect of any discrepancies found.
- B. Reference Standards:
  - 1. Local Jurisdictions: Perform work in accordance with municipal agency and utility company standards and requirements.
  - 2. American Association of State Highway and Transportation Officials (AASHTO): Standards.
  - 3. American National Standards Institute (ANSI): Standards.
  - 4. American Society of Testing Materials (ASTM):
    - a. General: Materials and testing standards as identified throughout this Section.
    - b. ASTM D2487: Classification of Soils for Engineering Purposes.
  - 5. State of California, Department of Transportation: Standard Specifications.
  - 6. California Occupational Safety and Health Administration (CalOSHA): Construction Safety Orders.
  - 7. California State Industrial Accident Commission (CSIAC): Trench Construction Safety Orders.
  - 8. U.S. Occupational Safety and Health Administration (OSHA): Standards - 29 CFR, PART 1926 Safety and Health Regulations for Construction, Subpart P - Excavations.

9. California Environmental Protection Agency Department of Toxic Substances Control (DTSC): Information Advisory Clean Imported Fill.
- C. Testing: Refer to Section 01 45 29 - TESTING LABORATORY SERVICES.
  1. Geotechnical Engineer: A Geotechnical Engineer will be retained by the Owner to observe performance of and determine compliance with excavation, trenching, soil treatment, filling, backfilling and grading requirements; and perform testing.
  2. Retesting: Paid for by School District and deducted from cost of Contract.

## **PART 2 - PRODUCTS**

### **2.1 FILL MATERIALS:**

- A. Engineered Fill: Approved native on-site materials supplemented with approved import material as needed. Imported soil must meet the guidelines established in the "Information Advisory for Clean Imported Fill" published by the DTSC. Approval of soil to be imported must be obtained prior to delivery to site.
  1. [Imported Non-Expansive Fill: Granular, compactable soil subject to approval of geotechnical engineer with plastic index less than 15, expansion index less than 20, maximum particle size of 3 inches, and shall have less than 5 percent of the material greater than 1 inch in greatest dimension.][ Inorganic R value of 25, liquid limit less than 30, plastic index 5 to 15, with the following gradations:

<u>Sieve Size</u>	<u>Percentage Passing</u>
a. 3 inch	100 percent
b. 3/4 inch	70-100 percent
c. No. 4	50-100 percent
d. No. 200	0 - 40 percent]
  2. On-Site Fill: On-site native soil; free of organic or deleterious material; no rocks or lumps larger than **3** inches in any dimension.
- B. Trench Backfill: On-site native soil; free of organic or deleterious material; no rocks or lumps larger than 3 inches in any dimension. No more than 15 percent of material shall be larger than 1 inch in any dimension].
- C. Aggregate Fill:
  1. General: Materials free of silt, clay, loam, shale, friable or soluble materials, debris, vegetation and foreign matter.
  2. Sand: ASTM C144.
  3. Drain Rock: Crushed rock, natural rock, or pea gravel. Grading: ½ inch minimum, 2 inches maximum.
  4. Aggregate Base: CalTrans Standard Specifications, Section 26, Class 2 aggregate base; 3/4 inch maximum.

- 5. Permeable: Class 2 permeable material per CalTrans Section 68 or mixture of coarse and fine aggregates as routinely proportioned for concrete mix design with 1 inch maximum aggregate per ASTM C33.
- D. Trench Bedding Materials: Refer to Section 33 00 00 – SITE UTILITIES, Section 33 40 00 – STORM DRAINAGE UTILITIES, Division 22 – PLUMBING, Division 23 – HEATING, VENTILATING AND AIR CONDITIONING, or Division 26 – ELECTRICAL GENERAL REQUIREMENTS for bedding materials required for buried materials specified in their respective sections.
- E. Concrete Fill: Refer to Section 03 30 00 – CONCRETE.
- F. Topsoil:
  - 1. Native: Stripped or excavated material containing organics, free of roots, rocks larger than 1½ inch in least dimension, debris, vegetation and foreign matter. Top 4 inches of soil below existing grade is defined as native topsoil.
  - 2. Imported: Friable loam; free of roots, rocks larger than ½ inch, subsoil, debris, vegetation, and foreign matter, with an acidity range (pH) of 5.5 to 7.5, containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.

## **2.2 GEOTEXTILE FABRIC**

- A. N-Series geotextiles manufactured by Mirafi, Inc or Amocco 4546, or equivalent

## **2.3 SOIL TOXICANT MATERIAL**

- A. Refer to Section 31 31 00 – SOIL TREATMENT.

## **2.4 WATER**

- A. Potable; free of deleterious materials.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. General: Verify site conditions shown, report all unidentified conditions to the Architect.
- B. Utilities: Verify locations of existing utilities by pot-holing. Examine site for unidentified utilities. Should such utilities be discovered, do not proceed until identified and instructions are received from responsible utility company.
- C. Archaeological Artifacts: Should any objects of possible historic interest be encountered during operations, halt work in area of discovery and immediately contact the Architect for notification of appropriate authorities.

**3.2 PREPARATION**

- A. Environmental Requirements: Do not place, spread or compact fill material during unfavorable weather conditions. When work is interrupted by rain, do not proceed with fill operations until field tests indicate that moisture content and density of previously placed fill is satisfactory.
- B. Coordination: Keep Owner, Inspector, Architect, Testing Lab, and Geotechnical Engineer informed of progress of work and changes in schedule in order to facilitate Owner's verification engineered fill construction and unit price excavation.
- C. Layout:
  - 1. General: Establish lines, levels and grades; locate work, including existing underground utilities; set markers and stakes. Construction staking to be performed by civil engineer or land surveyor licensed by the State of California.
  - 2. Trees and Shrubs: Tag or identify existing plant life designated to remain.
- D. Protection:
  - 1. General: Erect and maintain barricades and protection facilities, as required.
  - 2. Bench Marks: Protect survey control points from damage or displacement.
  - 3. Utilities:
    - a. General: Maintain and protect existing utilities to remain. Schedule interruption of service required by work of this Section.
    - b. Location of Utilities: Should the location of existing utilities differ from location shown or are found to interfere with permanent facilities being constructed under this Section, immediately notify the Architect. Do not proceed until written instructions are received from the Architect.
    - c. Unknown Active Utility Lines: Should unknown active utilities be encountered during work, halt operation, take such action required to assure that service is not interrupted, and promptly notify the Architect.
  - 4. Underpinning: Underpin adjacent structures, including service utilities and pipe chases, as required to prevent damage or erosion by excavation work.
  - 5. Shoring, Sheet piling, Lagging and Bracing: Provide as required to maintain excavations and banks in a safe and stable condition and resist erosion.
  - 6. Plant protection: Carefully protect existing trees and shrubs identified to remain per Section 01 56 39 – TEMPORARY TREE AND PLANT PROTECTION. Replace existing trees and shrubs outside construction area damaged by operations.
  - 7. Explosives: Do not use explosives.
  - 8. Drainage: Conduct grading operations in such a manner as to prevent surface water run-off from ponding in areas to be worked or from flowing into excavation or on to adjacent properties. Keep excavations and sub-grade area free from water during process of work, regardless of cause,

source or nature of water. Direct or pump drainage to temporary drainage or collection system. Excess water interfering with progress of work shall be disposed of off site.

9. Dust Control: Wet as required.

### 3.3 PERFORMANCE

- A. General: Clear and grub site. Excavate, fill, compact, and grade to achieve finish grades, lines, levels and contours shown.
1. Subgrade Elevations: Subgrade is defined as the top surface of subsoil immediately below any topsoil or aggregate fill. Determine subgrade elevations by subtracting the thickness of pavement section, topsoil, or slab and aggregate fill from the finish elevations shown.
  2. Compaction: ASTM D1557 Compaction Test method; value of optimum moisture content and density will be determined by Geotechnical Engineer, unless otherwise noted.
  3. Moisture Condition: Wet and mix soil to uniform moisture content of between 2 and 5 percent above the optimum moisture content or as required by Geotechnical Engineer **on** site. When moisture content is too high to achieve compaction, aerate by blading or other methods until moisture content is satisfactory.
- B. Demolition:
1. General: Per Section 02 41 00 - DEMOLITION.
  2. Existing Paving: Remove and recycle concrete and asphalt concrete paving from site unless designated to remain.
  3. Other Obstructions: Remove abandoned utility lines, concrete foundations, etc. Backfill resulting holes as specified.
- C. Clearing and Grubbing:
1. General: Remove surface vegetation, debris, and other deleterious materials in areas designated for construction.
  2. Trees and Shrubs: Remove as indicated, including stumps, main root ball and root system as required.
  3. Organic Soils: Soils high in organics shall be stockpiled for use as top soil or removed from site.
  4. Processing Original Ground Surface: The exposed soils in all areas of the site shall be processed to a depth of not less than 12 inches and not more than 18 inches. The processing shall be accomplished by use of rotary mixing equipment capable of breaking up soil clods to particles less than 1½ inches in least dimension and uniformly blending the soil and remaining vegetation to concentrations considered to be insignificant to the Geotechnical Engineer.
- D. Excavation:



1. General: Excavate, fill, compact, and grade to achieve finish grades, lines, levels and contours shown.
2. Subsoil: Excavate subsoil required for building foundations, slabs, construction operations and other work. Stockpile subsoil in designated area on site; remove excess subsoil not being reused from site. Protect stockpiled subsoil from erosion until removed for final placement
3. Topsoil:
  - a. Stripping: Excavate topsoil to condition specified, free of rocks and organic debris, from areas to be further excavated, re-landscaped, or re-graded; do not mix with foreign materials.
  - b. Stockpiling: Stockpile in area designated on site to depth not exceeding 8 feet; protect from erosion. Provide quantity great enough to provide minimum 8 inch layer of material at areas designated for planting; supplement with imported topsoil, if required. Remove excess topsoil not intended for reuse, from site **[and recycle]**.
4. Overexcavation:
  - a. General: Overexcavate to expose undisturbed native soils (anticipated to be at a depth of 18 inches below the ground surface). Extend excavation a minimum of 5'-0" beyond building limits and 2'-0" beyond paving limits.
  - b. Accidental Overexcavation: Report to geotechnical engineer and repair as directed.
  - c. Unsuitable Ground: Report soft ground or other unsuitable soil found when excavating to the geotechnical engineer; do not build on any soft or unsuitable surface. Repair as directed by the geotechnical.
5. Original Ground Surface Preparation:
  - a. General: At areas to receive pavement or structures, scarify and recompact existing ground as described below. Scarification and recompaction not required at areas to receive landscaping or shallow top soil fill.
  - b. Scarification: Subgrade soils exposed by excavation or subgrade soils that have been allowed to desiccate prior to placement of fill, slabs or pavements, shall be disked or plowed to depth of 6 inches.
  - c. Moisture Conditioning: After scarification and prior to compaction, the soils on which fill will be placed, and soil subgrade areas achieved by excavation or left at existing grade, shall be moisture conditioned to at least 2 percent above the optimum moisture content.
  - d. General Compaction: Once the soils have been moisture conditioned to the satisfaction of the Geotechnical Engineer's representative, the soil shall be compacted to at least 90 percent of the ASTM D1557 maximum dry density for building pads and exterior flatwork.
  - e. Compaction at Asphalt Pavement: In pavement areas, the upper six inches of subgrade soils shall be compacted to at least 95 percent of the maximum dry density, regardless of whether the subgrade surface is achieved by excavation, filling or is near the original site grade.
6. Trenches:

- a. General: Excavate to achieve required levels. Comply with requirements of jurisdictional agencies.
  - b. Utility Trenching: Excavate straight and true to line and grade and sufficiently wide to enable installation and allow for inspection. Excavate to depth required to for utility installation at grades shown allowing for minimum cover, installation of crossing utilities, and required depth of bedding below utilities. Refer to Section 33 00 00 – SITE UTILITIES, Section 33 40 00 – STORM DRAINAGE UTILITIES, Division 22 – PLUMBING, Division 23 – HEATING, VENTILATING AND AIR CONDITIONING, and Division 26 – ELECTRICAL GENERAL REQUIREMENTS for additional requirements affecting trenching.
  - c. Footings: Excavate to adequate width to allow for installation of formwork. Where earth is sufficiently stable to retain its position during concreting and concrete will be poured directly into excavation, cut trench a minimum of 2 inches larger than shown.
- E. Bedding: Install as specified for buried material. Refer to Section 33 00 00 – SITE UTILITIES, Section 33 40 00 – STORM DRAINAGE UTILITIES, Division 22 – PLUMBING, Division 23 – HEATING, VENTILATING AND AIR CONDITIONING, or Division 26 – ELECTRICAL GENERAL REQUIREMENTS for respective requirements.
- F. Filling and Backfilling:
- 1. General: Perform fill and backfill operations in the presence of the Geotechnical Engineer who will make field density tests to check compaction of fill material. Remove shoring, sheeting, lagging and bracing prior to commencing operations. Fill to subgrades established by finish contours and elevations shown.
  - 2. Soil:
    - a. General: Use On-Site Engineered Fill under buildings and paving areas except where Imported Non-Expansive Engineered Fill is called for on Drawings. Place in layers not exceed 9 inches in loose thickness; rocks larger 3 inch not permitted in the upper 12 inches of fill.
    - b. Moisture Condition: Moisture condition, uniformly mix, and evenly spread each layer.
    - c. Compaction: After each layer has been placed, mixed and spread, compact to the following percentages of maximum dry density:
      - i. 90 Percent: All fills unless specified otherwise.
      - ii. 95 Percent: Upper **[six inches]** of fill or existing soils below asphalt pavement.
      - iii. 85 Percent: Trench backfill in landscaped areas
      - iv. Fill in Trenches and Adjacent to Walls: Backfill with material excavated, unless otherwise shown. Moisture condition place in 6 inch layers and compact each layer to density specified for adjacent material. In trenching through native soil compact to 90 percent relative compaction. Backfill simultaneously on each side of un-braced foundation walls, or utility pipes, conduits or structures.
  - 3. Aggregate Fill:
    - a. General: Do not place fill on soft, muddy, or frozen surfaces.
    - b. Base: Spread aggregate over prepared substrate to a total compacted thickness as shown. Compact to 95 90 percent of maximum dry density.

- c. Drain Rock: Place after underground work and foundations are in place; Compaction is required under buildings or paved areas where depth of free-draining aggregate exceeds one foot. Place fill in one foot lifts and make one pass with vibratory type compaction equipment at each lift.
- d. Permeable: Place as shown.

**G. Grading:**

- 1. General: Uniformly grade to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines and elevations shown. Cut out soft spots, fill low spots, and trim high spots.
- 2. Adjacent Grades: Provide smooth transition between adjacent existing grades and new grades.
- 3. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations established by finish grades and contours to within the following tolerances:
  - a. Landscaped or unpaved areas: Plus or minus .01 feet.
  - b. Walks: Plus or minus .01 feet.
  - c. Pavements: Plus or minus ½ inch.
  - d. Under buildings: Plus or minus ½ inch.

**3.4 FIELD QUALITY CONTROL**

- A. Field Testing: Refer to Section 01 45 29 - TESTING LABORATORY SERVICES.
- B. Retesting: Make necessary corrections to non-conforming work; retest at Contractor's expense.
- C. Record Survey By Owner: Location, size and elevation of building pads and depth of engineered fill at building pads will be verified by a Land Surveyor licensed in the State of California. Pad certification will be at Owner's expense with the following exception: If any pads are found to have been constructed incorrectly, subsequent verifications costs for rechecking pads will be back charged to the contractor and deducted from the contract amount.]

**3.5 CLEANING**

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris. Do not bury or burn rubbish on the site.

**END SECTION 31 00 00**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes asphalt concrete paving and related work as shown and specified.

**1.3 SUBMITTALS**

- A. Paving Materials: Submit certificates that materials comply with specified requirements.
- B. Wheel Stops: Per product data and manufacturing installation instructions.
- C. Closeout Submittals:
  - 1. Provide completed Guarantee form per Article 1.5.

**1.4 [GUARANTEE**

- A. Provide in required form for a period of 2 years from date of acceptance by Owner.

**PART 2 - PRODUCTS**

**2.1 BASE COURSE AGGREGATE**

- A. General: CalTrans Standard Specifications, Section 26, Class 2 aggregate base; 3/4 inch maximum.
- B. Asphalt Binder: Steam-refined paving asphalt per CalTrans Standard Specifications, Section 92, Grade PG 64-10.

**2.2 SURFACE COURSE AGGREGATE**

- A. Mineral aggregates for Type "B" asphalt concrete, per CalTrans Standard Specifications, Section 39-02, Type B, ½ inch maximum grading.

**2.3 SEAL COAT:**

- A. Acceptable Products: OverKote Asphalt Pavement Coating, as manufactured by RaynGuard Protective Materials, Inc.
- B. Alternate Products: Comparable products manufactured by Reed and Graham, Inc. Proposed equals are subject to substitution process per Section 01 33 00 – PRODUCT SUBMITTALS AND SUBSTITUTIONS.]

**2.4 WOOD HEADERS AND STAKES**

- A. Foundation Grade Redwood.

**2.5 LINE PAINT**

- A. FS TT-P-1952, Class A traffic paint; colors as listed below.

**2.6 WHEEL STOPS**

- A. Acceptable Products: Precast Concrete Bumper Block, product number M20WBB, manufactured by Christy, a division of Oldcastle Precast, Inc., or product number PPC 130, manufactured by Teichert Precast.
- B. Alternate Products: Must be equal in appearance, function, and installation. The attributes of products that will be accepted as equal include but are not limited to the following:
  - 1. Minimum Dimensions: 5 ¼ inches high, 7 ½ inches wide, 36 inches long.
  - 2. Construction: Minimum 4000 psi concrete with steel reinforcement.

**2.7 MIXES**

- A. General: Plant mixed per CalTrans Standard Specifications, Section 39, Type B, ½ inch maximum grading.
- B. Temperature of Asphalt: 275 degrees F minimum; 325 degrees F maximum, when added to aggregate.
- C. Temperature of Aggregate: 250 degrees F minimum; 325 degrees F maximum, when asphalt is added.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- A. Take field measurements; report variance between plan and field dimensions.
- B. Environmental Requirements:
  - 1. Base Course: Do not lay during wet weather, on muddy sub-grade, or when atmospheric temperature is below 35 degrees F.
  - 2. Asphalt Surfacing: Do not apply during wet weather, on wet base course, or when atmospheric temperature is below 40 degrees F.

- C. Preparation of Subgrade: Clean, shape and compact to hard surface free from elevations or depressions exceeding 3/8 inch in 10'-0" from true plane. Compact to not less than 95% of maximum dry density per ASTM D1557, as specified under Section 31 00 00 – EARTHWORK AND TRENCHING.
- D. No pavement marking to be performed until Architect has approved the marking placement.

### 3.3 INSTALLATION

- A. Required Thickness After Compaction:
  - 1. Aggregate Base Course: As shown.
  - 2. Asphalt Concrete Surface Course: As shown.
- B. Headers:
  - 1. General: Install at edge of asphalt paving, except where adjacent to existing pavement, concrete curbs, walks or building. Use ½ inch thick boards where required for bending.
  - 2. Existing Headers: Remove where new paving will join existing.
  - 3. Lines and Levels: Install true to line and grade. Nail stakes at spacing shown, with 2 - 16d galvanized common nails. Cut off tops of stakes at an angle to reduce their visibility on completion.
- C. Asphalt Paving:
  - 1. Aggregate Base Course: Install per CalTrans Standard Specifications, Section 26; compact to relative compaction of not less than 95%, ASTM D1557.
  - 2. Soil Treatment: Apply toxicant chemicals per manufacturer's instructions over entire base course area just prior to application of asphalt.
  - 3. Asphalt Binder: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed. Apply at rate of 0.02 to 0.10 gallons per square yard of surface.
  - 4. Asphalt Concrete Surface Course:
    - a. General: Per CalTRANS Standard Specifications, Section 39-6 except as modified below.
    - b. Final Gradation: Smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 95% of maximum theoretical unit weight as determined by California Test Method No. 304. Maximum variation 1/8 inch in 10'-0" when measured with steel straightedge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix.
  - 5. Seal Coat: Thoroughly clean all surfaces of dust, oil spots and other foreign material. Apply a minimum of 30 days after placement of paving. Mix and apply per manufacturer's instructions. Apply 2 coats, minimum, at a rate of 30 gallons of material per 1,000 square feet, minimum. Additional applications may be required to provide uniform surface.

## **FLEXIBLE (ASPHALT) PAVING - SECTION 32 12 00**

### **Page 4**

- D. Patching: Cut existing paving square and plumb at all edges to be joined by new paving. Prime vertical surfaces before installing new work. Warp carefully to flush surface, with seal over joints, and feather edge. Patch existing paving where cut for installation of piping or conduits under Division 22 – PLUMBING, Division 23 – HEATING, VENTILATING AND AIR CONDITIONING, and DIVISION 16 - ELECTRICAL.
- E. Line Painting:
  - 1. General: Apply 2 coats of paint to clean, dry surfaces; do not thin paint. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
  - 2. Apply paint to produce pavement markings with uniform, straight edges and even thickness. Overspray and overspill will not be accepted.
  - 3. Striping and Symbols: As shown at asphalt and portland cement concrete pavement, walks, stairs, and ramps.
  - 4. Colors:
    - a. Striping and Lettering: White.
    - b. Time Limited Parking: Green.
    - c. Disabled Access: Blue; match Color No. 15090 of Federal Standard 595A.
    - d. Caution and Bus Loading: Yellow.
    - e. Fire Lane: Red.
    - f. Black Out Striping: Black.
- F. Wheel Stops: Install where shown, secure with epoxy adhesive and 2 reinforcing steel bars ½-inch diameter by 24 inches long, galvanized, driven flush with top of concrete bumper; do not damage bumpers or asphalt concrete paving.

END SECTION 32 12 00

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes site utility services and related work as shown and specified.

**1.3 SUBMITTALS**

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.
- B. Certificates: Submit certificate in lieu of manufacturer's name and pressure rating marked on valve body of valves and gas cocks, as required.
- C. Closeout:
  - 1. O & M Manuals: Maintenance instructions.
  - 2. Guarantee: Provide completed form per Article 1.5.

**1.4 QUALITY ASSURANCE**

- A. Qualifications: Welders to be AWS certified.

**1.5 GUARANTEE**

- A. Provide in required form for a period of 1 year from date of acceptance by Owner.

**PART 2 - PRODUCTS**

**2.1 PIPING**

- A. General: Refer to Division 22 – PLUMBING for detailed pipe and fitting requirements.
- B. Sanitary Sewer:
  - 1. Outside Property Line: Per applicable utility service regulations and standards.
  - 2. Within Property: PVC, SDR 35
  - 3. Manholes: As shown, per jurisdictional requirements.
- C. Water:



## **SITE UTILITIES - SECTION 33 00 00**

### **Page 2**

1. To Meter and Detector Check: Per applicable utility service regulations and standards.
2. Potable Water from Meter: As shown.
  - a. 4 Inch and Larger:
    - i. General: PVC, AWWA C900, Class 150.
    - ii. Fire Prevention: PVC, AWWA C900, Class 200.
  - b. 3 Inch and Smaller: Copper; pressure Type[ K; joints 95/5 solder.
  - c. Meter: Per jurisdictional requirements.

## **2.2 VALVES**

- A. General: Outside property line, conform to applicable utility service regulations and standards.
- B. Valves:
  1. Water:
    - a. General: Per AWWA Standards.
    - b. Fire Protection: Per UL and FM Standards.
- C. Valve Boxes: As detailed. Precast concrete boxes with extensions and cast iron frame and cover. Cover marked "Water" or "Gas" applicable to valve.

## **2.3 BACKFLOW PREVENTORS**

- A. Per applicable utility service requirements.

## **2.4 DETECTABLE WARNING TAPE**

- A. Acid and alkali resistant polyethylene film manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.

## **2.5 BEDDING MATERIALS**

- A. Refer to Section 31 00 00 - EARTHWORK AND TRENCHING.

## **2.6 DRAINAGE SPECIALTIES**

- A. Per Section 33 40 00 – STORM DRAINAGE UTILITIES.

## **2.7 LANDSCAPE IRRIGATION SYSTEM**

- A. Per Section 32 84 00 - IRRIGATION.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Before trenching, verify site conditions shown; verify locations of existing utilities by pot-holing. Report any discrepancies to Architect. Do not begin affected work until discrepancies have been resolved. Examine site for unidentified utilities and unidentified site conditions. Report all discovered conditions or utilities to the Architect. Do not proceed with affected work until any conflicts have been resolved.

### **3.2 PREPARATION**

- A. Protection: Conform to "Trench Construction Safety Orders", California State Industrial Accident Commission.
- B. Coordination: Coordinate off-site service connections with utility companies. Coordinate connections within the building line with the respective building trades.

### **3.3 INSTALLATION**

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Lay out systems by instrument; verify location and elevation of points of utility service and existing crossing utilities prior to excavation; notify Architect of discrepancies noted.
- C. Lay pipe true to line and uniform grade commencing at point of utility service connection. Make connections to utility service and building systems.
- D. Excavation and Bedding:
  - 1. General: Per Section 31 00 00 - EARTHWORK AND TRENCHING. Trench width to be a minimum of 12 inches wider than outside diameter of pipe, bottom smooth and free of irregularities or rock points.
  - 2. Bedding: Provide bed of clean sand for the full length of the pipe; minimum 4 inches thick, or 1/8 the outside diameter of the pipe, whichever is greater. Provide bell holes and depressions for pipe joints only of size required to properly make joint.
- E. Gravity Flow Sanitary Sewer: Per manufacturer's recommendations for jointing and installation; provide manufacturer's adapters for jointing to other pipe materials.
- F. Water Piping:
  - 1. Jointing: Per manufacturer's recommendations.
  - 2. Thrust Blocks: Construct as detailed.
  - 3. Valves: Place at required locations, vertically plumb; set valve boxes to finish elevation.
  - 4. Utility Service Meters: Locate as shown.
  - 5. Sidewalk Hydrants: As shown, per local jurisdictional requirements.

**G. Backfilling:**

1. General: Per Section 31 00 00 - EARTHWORK AND TRENCHING; do not start backfill operations until required testing has been accomplished.
2. Detectable Warning Tape: Install directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs. Verify that inscribed description is properly coordinated with identified utility.
3. Trenches and Excavations: Backfill with clean sand to 12 inches above top of pipe, filling both sides of the pipe at the same time, carefully tamping to hold pipe in place without movement. Place in 6 inch lifts; compact each layer to density of adjacent undisturbed soil. Jetting will not be allowed.

**3.4 FIELD QUALITY CONTROL**

**A. Testing:**

1. General: Test systems for water tightness at a hydrostatic pressure as follows:
2. Gravity Sewer: 10 pounds per square inch for a period of 4 hours.
3. Water and Sewer Force Main:
  - a. General: 150 pounds per square inch for a period of 4 hours.

**B. Disinfection: Flush and disinfect per Section 33 13 00 - DISINFECTING.**

**C. Retesting: Make necessary corrections to work that is not in conformance with specified requirements and retest at Contractor's expense.**

**3.5 CLEANING**

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.**

**END SECTION 33 00 00**