SECTION 26 05 30
CONDUIT AND WIRE

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

B. Submit product data sheets for all wire, conduit, fittings and splicing materials.

PART 2 - PRODUCTS

2.01 CONDUIT

A. Rigid galvanized steel conduit: Hot-dip galvanized, zinc coated. Threads shall be galvanized after fabrication. Couplings, connectors and fittings shall be threaded.

B. Electrical metallic tubing: Galvanized. Couplings and connectors, seamless steel construction and of the set screw or water-tight compression type with factory-applied permanently-attached insulated throat. Thomas & Betts Co. #5123 or #5031 Series or approved equal connectors and #5120 or #5030 Series or equal couplings.

C. Flexible conduit: Galvanized steel. Connector shall be screw-in type with factory-applied permanently-attached insulated throat. Bridgeport #520-DCI/521-DCI Series or equal by Efcor.

D. Liquid-tight flexible conduit: Sealtite Type U.A. with Appleton Series "ST" connectors.

E. Nonmetallic conduit: Polyvinyl chloride, Schedule 40.

F. Seismic deflection/expansion fittings with bonding jumper, O.Z. Type DX Series or equal.

2.02 WIRE AND CABLE

A. All wire and cable shall be copper, 600 volt, #12 AWG minimum unless indicated otherwise. Conductors #10 AWG and smaller shall be solid. Conductors #8 AWG and larger shall be stranded. Type of insulation as noted on drawings and as follows:

1. Type THHN/THWN insulation used for #4 AWG and smaller.
2. Type THHN/THWN insulation used for #2 AWG and larger.
3. Type THHN/THWN used for all panel feeders and service conductors.
4. Type THHN/THWN insulation shall be used where conductors are installed in conduit exposed to the weather.
5. The following color code for branch circuits:

   Neutral . . . White (Tape feeder neutrals with white tape near connections) where separate neutral conductors are indicated for branch circuits, color code the white neutral conductor with a colored stripe corresponding to the phase of the respective line conductors.

   120/240 Volt

   Ground Green

   Phase A Black

   Phase B Red
6. Feeders identified as to phase or leg in each panelboard with printed identifying tape.

PART 3 - EXECUTION

3.01 TRENCHING, FOOTINGS, SLEEVES

A. Provide trenching, backfilling, and compaction for the underground electrical work, in accordance with applicable Sections of this Specification.

3.02 GROUNDING

A. Grounding shall be executed in accordance with all applicable codes and regulations, both of the State of California and local Authorities Having Jurisdiction.

B. Where nonmetallic conduit is used in the underground distribution system, the Contractor shall install the proper sized copper ground wire in the conduit with the feeder for use as an equipment ground. The electrical metallic raceway system shall be grounded to this ground wire.

C. The maximum resistance to ground shall not exceed 25 ohms.

D. Where an equipment bonding ground wire is installed or where nonmetallic or flexible conduit is used for feeder, subfeeder or branch circuit wiring, a green insulated, copper ground wire, sized in accordance with the following table, shall be installed. Install ground wire in each conduit with phase conductors.

E. Where conductors are run in parallel in multiple raceways, the grounding conductor shall be run in parallel. Each parallel equipment grounding conductor shall be sized on the basis of the ampere rating of the overcurrent device protecting the circuit

conductors in the raceway. When conductors are adjusted in size to compensate for voltage drop, grounding conductors, where required, shall be adjusted proportionately in size.

F. Ground conductors for branch circuit wiring shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws, 6-32 or larger.

G. Each panelboard, switchboard, pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

3.03 CONDUIT

A. The sizes of the conduits for the various circuits shall be as indicated on the drawings and as required by Code for the size and number of conductors to be pulled therein. Conduits to be concealed except as noted otherwise.

B. Rigid steel conduit shall be used where exposed on exterior of building.

C. Rigid galvanized steel conduit shall not be installed in direct contact with earth or sand.

D. PVC Schedule 40 nonmetallic conduit shall be used for all underground runs unless specifically noted or specified otherwise. Nonmetallic conduit shall not be run in slabs or walls, above ceilings or exposed.

E. Risers on underground conduit runs shall be PVC Schedule 40 below grade and rigid galvanized steel where the run turns up above finished grade.

F. Electrical metallic tubing up to and including 4 inches may be installed as permitted by Codes except as otherwise referenced within these Specifications.

G. Flexible Steel Conduit:

1. Flexible steel conduit may be used where concealed in walls or above ceilings.

H. Conduit Installation:

1. Securely and rigidly support all conduits from building structure. Provide supports maximum of 10-feet on centers and within 3-feet of all bends, outlets, junction boxes, cabinets, panels and fittings. Conduits shall be supported independent of all piping, duct work, equipment ceiling hanger wires, and suspended ceiling grid systems. Secure by means of approved pipe clamps or straps. The use of "plumbers tape" is prohibited.

2. Individual suspended conduits shall be supported by means of hanger rods and pipe clamps. Multiple suspended conduits shall be supported by means of trapeze type hangers and pipe clamps. Conduits and conduit support systems shall be guyed to prevent swaying in any direction.

3. Individual conduits placed against brick, masonry or concrete walls or slabs shall be secured with pipe clamps and expansion shields. Individual conduits placed against dry wall or plaster construction shall be secured by means of pipe clamps and screws attached to studs or other structural members. The use of toggle bolts is prohibited. Provide preformed channel supports for all multiple conduits placed against walls or slabs.
4. Rigid steel conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock absorbing bases.
5. Conduit run exposed shall be run at right angles or parallel to the walls or structures. All changes in directions, either horizontally or vertically, shall be made with conduit outlet bodies as manufactured by Crouse Hinds or equal. Conduits run exposed shall be painted to match surrounding surfaces.
6. Individual conduits penetrating a fire-rated floor, wall, or ceiling shall be installed using an approved fire-stop sealant system equal to 3M Corporation FS-195/CP-25 or Hilti Inc. CS240 Series.
7. Underground conduits entering concrete pullboxes shall enter the side walls of the pullbox unless indicated otherwise. Provide end bell fitting on the end of each conduit 2-inches or larger entering the pullbox. Provide waterproof sealant after conductors have been installed.
8. Provide metallic or plastic caps on all conduit during construction until installation of conductors.
9. Provide expansion and deflection fittings, and bonding jumper at all building expansion crossings and seismic joint crossings.
10. Provide all trenching, excavation, shoring and backfilling required for the proper installation of underground conduits. Make trenches a minimum of 6 inches wider than the duct bank. Compaction to be as directed by Architect.
11. Install underground conduit, except under buildings, not less than 24-inches below finished grade in non-traffic areas and 30-inches below finished grade in traffic areas, including roads and parking areas. Install long radius bends in all underground conduits in excess of 100 feet long.
12. Conduit below slab on grade or underground exterior to building shall be spaced a minimum of 3-inches between identical systems and 12-inches between power and all other systems except at termination points. Multiple conduits in common trenches shall be racked on prefabricated plastic spacers a minimum of 10 feet on center over the length of the trench.
13. All conduits below grade under paved areas shall be backfilled to within 12-inches of finished grade with compacted damp sand. All conduits below grade under non-paved areas shall be backfilled to within 12-inches of finished grade with 2-sack concrete slurry.

14. Where concrete encasement is specified, provide a minimum of 3-inches of concrete between each conduit, the top, bottom and sides of the duct bank.

15. The Contractor shall demonstrate the usability of underground raceways installed as part of this Contract. A round tapered rigid mandrel with a diameter approximately ¼-inch smaller than the diameter of the raceway shall be pulled through after the raceway installation is completed. Conduits which stub-out only, shall have the mandrel pulled before and after the concrete encasement is completed, but prior to completing the backfill. The raceway testing for usability shall be witnessed by the District Representative and by a Representative of the respective Utility Company where applicable. Contractor shall repair/replace any conduit which will not readily pass the mandrel test.

16. Provide a yellow or red magnetic detector tape over the entire length of all underground conduits. Place tape in backfill at a depth not to exceed 12 inches below finish grade or as required by the Manufacturer.

17. All ductbanks with sand and concrete cover shall be backfilled to finished grade with native soil having no stones or aggregate greater than 3-inches. Do not backfill until installation has been approved and as-built drawings are up to date. Promptly install all conduits after excavation has been done, so as to keep the excavations open as short a time as possible. All excess soil from trenching shall be removed from the site.

18. Conduits which are installed at this time and left empty for future use shall have 3/8-inch polyvinyl rope left in place for future use.

3.04 WIRE AND CABLE

A. Branch circuit and fixture joints for #10 AWG and smaller wire shall be made with ULapproved connectors listed for 600 volts, approved for use with copper and/or aluminum wire. Connector to consist of a cone-shaped, expandable coil spring insert, insulated with a nylon shell and 2 wings placed opposite each other to serve as a built-in wrench or shall be molded one-piece as manufactured by "Scotchlok".

B. Branch circuit joints of #8 AWG and larger shall be made with screw pressure connectors made of high strength structural aluminum alloy and UL-approved for use with both copper and/or aluminum wire as manufactured by Thomas & Betts. Joints shall be insulated with plastic splicing tape, half-lapped and at least the thickness equivalent to the conductor insulation. Tapes shall be fresh and of quality equal to Scotch.

C. Use UL listed pulling compound for installation of conductors in conduits.

D. Correspond each circuit to the branch number indicated on the panel schedule shown on the drawings except where departures are approved by the Architect or the District's Inspectors.

E. All wiring, including fire alarm, shall be installed in conduit.

F. Control wiring to conform to the Mechanical and Plumbing Specifications and wiring diagrams shown on the drawings and the Manufacturer's wiring diagrams.

G. All splices in exterior pull boxes shall be cast resin encapsulated. Power conductor splices - 3M Scotchcast Series 82/85/90; Plymouth or equal. No underground splices shall be made in control or signal circuits.

1. Power conductor splices - 3M Scotchcast Series 82/85/90; Plymouth or equal.

H. Neatly group and lace all wiring in electrical boards, and terminal cabinets with plastic ties at 3" on centers. Tag all spare conductors.

3.05 TESTING (ADDITIONAL REQUIREMENTS)

A. Visual and mechanical inspection of cables - 600 volts and less.

1. Inspect cables for physical damage and proper connection.
2. Test cable mechanical connections to Manufacturer's recommended values with a calibrated torque wrench.
3. Check cable color coding and labeling of conductors and spares.

B. Electrical Tests of cables - 600 volts and less.

1. Perform "megger" tests on each feeder and power circuit No. 8 AWG and larger with respect to ground and between conductors.

END OF SECTION