

TECHNICAL SECTION - 260533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
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SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish and install conduits as required, and as shown on the Plans. Materials employed shall be as shown on the Plans.

1.2 SUBMITTALS

- A. Submit product literature including manufacturer part number, model number, material, size, and specifications. Material shall not be installed until the Engineer has reviewed the submittal data.
- B. If changes from the Plan are proposed, shop drawings shall be submitted for review and acceptance showing routing, conduit size, and number and size of wires in each conduit before installation of conduit and any related work.
- C. Proposed routing of conduits buried under floor slabs-on-grade.
- D. Identify conduit by conduit schedule designation.
- E. Proposed routing and details of construction including conduit and rebar embedded in floor slabs, columns, etc.
- F. Proposed location and details of construction for openings in slabs and walls for raceway runs.
- G. Refer to Section 26000 "General Electrical Requirements" for further submittal requirements.

1.3 REFERENCES

- A. American National Standards Institute (ANSI): C80.1, Rigid Steel Conduit - Zinc-Coated.
- B. National Electric Manufacturers Association (NEMA): RN-1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit.
- C. Underwriters Laboratories Inc. (UL):
 - 1. 1, Flexible Metal Conduit.
 - 2. 6, Rigid Metal Conduit.
 - 3. 360, Liquid-Tight Flexible Steel Conduit.
 - 4. 467, Grounding and Bonding Equipment.
 - 5. 514, Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers.

6. 651, Schedule 40 and 80 Rigid PVC Conduit.
7. 870, Wireways, Auxiliary Gutters, and Associated Fittings.
8. 884, Underfloor Raceways and Fittings.
9. 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. Exposed conduits in an unclassified or non-hazardous area shall be Galvanized Rigid Steel (GRS) unless specifically indicated otherwise on the Plans. Conduits in corrosive, hazardous, or damp areas shall be PVC coated GRS unless otherwise indicated. Underground and/or concrete encased conduits shall be PVC, unless otherwise indicated. All conduits concealed in block walls or steel framing shall be PVC. All wiring, except as otherwise noted, shall be in conduit. Conduit size shall not be less than the National Electrical Code (NEC) size required for the conductors therein and shall not be smaller than 3/4-inch. No underground conduit shall be less than one inch. EMT shall not be permitted except in offices buildings.
- B. Condulet type fittings shall be Crouse-Hinds, Appleton, or equal with wedge nut covers. All condulets located outdoors, damp, or wet locations shall be weather tight.
- C. In unclassified areas, flexible conduit shall be grounding type, weatherproof, corrosion resistant, and watertight.
- D. Couplings, connectors, and fittings shall be standard types specifically designed and manufactured for the purpose. They shall be installed to provide a firm mechanical assembly and electrical conductivity throughout. Conduit systems shall be watertight.
- E. Expansion fittings shall be OZ type AX with jumper for exposed locations and type DX at structural expansion joints, Spring City, or equal. Conduits shall have expansion fittings in accordance with NEC.
- F. The conduits and fittings shall be supported per NEC requirements as a minimum.
- G. Sealing fittings shall be provided for classified areas per the NEC requirements in hazardous or corrosive areas. Fittings shall be poured after the final walk-thru unless otherwise directed in writing by the engineer.

2.2 GALVANIZED RIGID STEEL (GRS)

- A. Conduits and couplings shall be hot-dipped galvanized with zinc coated threads and outer coating of zinc bichromate, in accordance with ANSI C80.1 standards, as manufactured by Jones & Laughlin Steel Corporation, Allied Tube & Conduit Corporation, Triangle PWC, or equal.

- B. Steel conduit shall not be buried in earth without concrete encasement and additional corrosion protection. Instead buried steel conduit shall be PVC coated.
- C. GRS conduit shall be recoated with zinc after cutting and threading in the field.

2.3 PVC COATED GALVANIZED RIGID STEEL (PVC-GRS)

- A. PVC coated GRS conduit shall be installed where shown on the Plans or elsewhere specified and shall conform to NEMA RN-1 and ANSI C80.1 standards.
- B. The zinc surface of the conduit shall remain intact and undisturbed on both the inside and the outside of the conduit throughout the preparation and application processing. A Polyvinyl Chloride (PVC) coating shall be bonded to the galvanized outer surface of the conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 0.040-inch (40 mil).
- C. A loose coupling shall be furnished with each length of conduit. A PVC coating shall be bonded to the outer surface of the coupling and a PVC sleeve equal to the outside diameter of the uncoated conduit shall extend beyond both ends of the coupling approximately one pipe diameter or 1-1/2 inches, whichever is smaller. The wall thickness of the coating on the coupling and the sleeve shall be a minimum of 0.055-inch (55 mil).
- D. A PVC coating shall be bonded to the inner and outer surface of all conduit bodies and fittings and a PVC sleeve shall extend from all hubs. The wall thickness of the coating on conduit bodies and fittings and the sleeve walls shall be identical to those on couplings in length and thickness. The covers on all conduit bodies shall be coated on both sides and shall be designed to be completely interchangeable. The inside of conduit bodies shall remain undisturbed in the processing.
- E. Type 316 stainless steel screws shall be furnished and used to attach the cover to the conduit body. All coated material shall be installed and patched according to the manufacturer's recommended installation and patching instructions.
- F. Conduit straps shall be stainless steel.
- G. PVC coated conduits and fittings shall be as manufactured by KorKap Corporation, Occidental Coating Company, Rob-Roy, or equal.
- H. PVC coated flexible conduits shall be liquid and vapor-tight and manufactured in accordance with UL 360 standards.

2.4 RIGID NONMETALLIC – PVC

- A. Where specifically indicated on the Plans, or elsewhere specified, conduit may be high density Schedule 40, 90 degrees C, heavy-duty PVC. The conduit shall be manufactured from virgin polyvinyl chloride compound which meets ASTM D1784, NEMA TC-2, ANSI C33.91, and UL 651 standards. Smoke emissions shall be limited to less than 6 grams per 100 grams of material tested.

2.5 Where conduit concrete encasement is indicated on the Plans, conduit supports shall be installed at five-foot intervals. PVC conduit shall be manufactured by Carlon, Triangle Conduit & Cable, or equal LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Liquid tight flexible metal conduit shall be liquid and vapor-tight, oil and ultraviolet ray resistant and manufactured in accordance with UL 360 standards. Liquid tight flexible metal conduit shall be formed of a continuous, spiral wound, galvanized steel core with an extruded PVC jacket. The PVC jacket shall be rated for high ambient heat applications, 90 degrees Celsius.
- B. For corrosive locations, liquid tight flexible metal conduit shall be formed of a continuous, spiral wound, aluminum core with an extruded PVC jacket. The PVC jacket shall be impervious to corrosive liquids and vapors and PVC coated fittings shall be utilized.
- C. An external bonding conductor shall be required for flexible conduit connections containing circuits rated at 60 amps or greater and for sizes 1 1/2 " or larger. Flexible conduits and connectors for 1 1/4 " and smaller shall be listed for grounding.
- D. For non-corrosive locations, connectors for liquid tight flexible conduit shall be galvanized, furnished with a sealing ring and locknut, and suitable for wet locations. For corrosive locations, connectors shall be galvanized PVC coated.
- E. Regardless of wet locations or non-corrosive environments, Flex connections shall be 316 Stainless Steel and be provided with a sealing ring.

2.6 ELECTRICAL METALLIC TUBING (EMT)

- A. Per UL Standard for Electrical Metallic Tubing No. 797. Galvanized mild steel with interior coat of enamel.
- B. Fittings shall be steel set-screw type. Cast type, indenter type or compression steel fittings are not acceptable.
- C. Approved for plan specified locations only. Approved for conduits concealed in block walls and concealed in steel framed walls. Not approved for process areas where wash down or high humidity conditions exist.

2.7 ALUMINUM CONDUIT

- A. Aluminum conduit is approved for wet and corrosive areas only. Prior approval from the engineer must be obtained when substituting for PVC coated.
- B. Aluminum hardware and conduit shall be isolated from all dissimilar materials as appropriate.
 - 1. Isolation from dissimilar metals in channel or support by a single layer of scotch #33+ or approved equal.
 - 2. Isolation from concrete shall be by neoprene gaskets.
 - 3. Aluminum shall not be used for concrete penetrations.
- C. Aluminum conduit shall contain less than 0.4% copper.

2.8 STAINLESS STEEL CONDUIT

- A. Stainless Steel Conduit is approved for all exposed conduit locations. Prior approval from the engineer must be obtained when substituting for PVC coated.
- B. Stainless Steel conduit and all fittings and support hardware shall be 316 SS.

2.9 CABLE TRAY SYSTEM

- A. Provide cable tray systems composed of straight sections, fittings, and accessories as defined in the latest NEMA Standards publication VE-1 - Ventilated Cable Tray.
 - 1. Provide cable trays and fittings shall constructed of materials suited for the area classification as noted below.
 - 2. Provide cable trays shall be of the ladder type with availability of 6, 9, and 12-inch spacing.
 - 3. Provide tray sizes with a 3, 4, 5, or 6-inch minimum usable load depth, as indicated on the drawings.
 - 4. Provide loading capacities that meet the NEMA weight classification with a safety factor of 1.5.
 - 5. In corrosive, damp, or Hazardous locations, provide cable trays manufactured of aluminum.
 - 6. In non-classified areas provide cable trays manufactured of Hot Dipped galvanized materials. All cuts and welds shall be touched up with cold galvanizing spray per the raceway specification.
 - 7. Separate power, control, signal and communications cables by grounded metallic dividers or run-in separate trays.
 - 8. Manufacturer, or Approved Equal
 - a. Husky
 - b. B-Line
 - c. T.J. Cope

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Conduit runs are schematic only and shall be modified as required to suit field conditions, subject to review and acceptance by the Engineer.
- B. Conduit shall run continuously between outlets and shall be provided with junction boxes where connections are made. Couplings, connectors, and fittings shall be acceptable types designed and manufactured for the purpose, and shall provide a firm mechanical assembly, and electrical conductivity throughout.
- C. Conduit runs shall be straight and true. Elbows, offsets, and bends shall be uniform and symmetrical. Changes in direction shall be made with long radius bends, or with fittings of the conduit type.
- D. Conduit runs in buildings and structures shall be concealed where possible except as specifically noted or accepted by the Engineer. Multiple conduit runs in a row should have couplings lined and uniform.
- E. Conduit runs shall not interfere with the proper and safe operation of equipment and shall not block or interfere with ingress or egress, including equipment removal hatches.
- F. Exposed conduits shall be securely fastened with clamps, or straps, intended for conduit use. All exposed conduit shall be run on the walls and ceiling only and shall be parallel to the planes of the walls or ceiling. No diagonal runs will be permitted. Flexible conduit shall be used only for short lengths required to facilitate connections between rigid conduit to vibrating equipment such as motors, fans, and transformers. The maximum length of flexible conduit shall be 3 feet, unless approved in writing by engineer. Flexible conduit shall not be used for electrician's convenience where rigid conduit could be used.
- G. Conduit runs on water-bearing walls shall be supported one inch away from the wall on an accepted channel. When channel galvanizing, or other coating, is cut or otherwise damaged, it shall be field coated to original condition. No conduit shall be run in water-bearing walls unless specifically designated otherwise.
- H. Conduit shall be thoroughly reamed to remove burrs. IMC or GRS shall be reamed during the threading process, and Rigid Nonmetallic PVC shall be reamed before applying fittings. A zinc rich cold galvanizing shall be used to restore corrosion protection on field cut threads.
- I. Bushings and lock nuts or hubs shall be used at conduit terminations. Conduit, bushings, locknuts, and enclosures shall be fastened to the conduit system prior to pulling wire. Splitting the bushings for installation will not be accepted. Hubs shall be used in all process areas outside of electrical rooms unless otherwise specified. The total number of bends in any run between pull points shall not exceed 360 degrees. Junction boxes and pull boxes shall be installed at points acceptable to the Engineer. Conduit ends shall be plugged to prevent the entrance of moisture or debris during construction. All spare conduits shall be adequately capped and shall contain a suitable pull string. Splices shall be made in junction boxes only.

- J. Splices in conduit bodies will not be accepted.
- K. Joints shall be set up tight. Hangers and fastenings shall be secure, and of a type appropriate in design, and dimensions, for the particular application.
- L. Conduit runs shall be cleaned and internally sized (obstruction tested) so that no foreign objects, or obstructions remain in the conduit prior to pulling in conductors.
- M. After installation of complete conduit runs 2-inches and larger, conduits shall be snaked with a conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the conduit. Conduits through which the mandrel will not pass shall not be used. Test results should be submitted to the engineer.
- N. Expansion fittings shall be installed across all expansion joints and at other locations where necessary to compensate for thermal expansion and contraction.
- O. Provide trenching, backfill, and compaction for conduits installed underground.
- P. Raceways running parallel to hot water or steam piping shall maintain a distance of 6-inches from the piping.
- Q. Raceways crossing steam or liquid filling piping shall cross above the piping. In slab conduits, shall be covered by a minimum of 2 inches of concrete.
- R. Conduits of the same duty (480V Power, 120V Power, 120V Controls and signals) shall have a minimum separation of 2 inches between conduits.
- S. Conduits and raceways carrying signal wiring shall have a minimum separation of 12 inches from 480V power raceways, 6 inches from 120V power raceways, and 4 inches from 120V control raceways.
- T. Raceways with 120V Control shall maintain a distance of 12-inches from 480V power raceways, 6-inches from 120V power raceways.

3.2 CABLE TRAYS

- A. Provide cable trays in strict accordance with the manufacturer's printed instructions.
- B. Allowable cable fill areas shall meet NEC Article 392 - Cable Trays requirements.
- C. Verify cable tray fills prior to installation based on cables and trays actually provided.
- D. Maintain continuous grounding of cable trays including bonding jumpers in accordance with the requirements of NEC Article 392

- E. Install cable trays using hangers and supports on 8-foot centers, maximum.
- F. Install cable trays to walls as the primary method of support where possible.

- G. If support from the ceiling is the only alternative, use hangers and supports on 6-foot centers, maximum.

- H. Ensure that proper separation between duties as detailed in 3.1.

END OF SECTION 260533

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