

SECTION 16111 - CONDUIT

GENERAL

1.1 SECTION INCLUDES

- A. Rigid metal conduit and fittings.
- B. Electrical metallic tubing and fittings.
- C. Flexible metal conduit and fittings.
- D. Liquid-tight flexible metal conduit and fittings.
- E. Non-metallic conduit and fittings.
- F. Fire stop materials.
- G. Conduit expansion joint fittings.

1.2 REFERENCES

- A. ANSI 70 - The National Electrical Code.
- B. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.
- C. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated.
- D. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- E. NEMA TC-2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- F. NEMA TC-3 - PVC Fittings for use with Rigid PVC Conduit and Tubing.

PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

- A. Acceptable Manufacturers:
 - 1. RGS Conduit/EMT:
 - a. Allied
 - b. Substitutions Or Approved Equal.
 - 2. PVC Coated RGS Conduit:
 - a. Robroy
 - b. Substitutions Or Approved Equal.
 - 3. PVC Schedule 40 Conduit:
 - a. Carlon

b. Substitutions Or Approved Equal.

- B. Rigid Steel Conduit: ANSI C80.1.
- C. PVC Externally Coated Conduit: NEMA RN1, rigid steel conduit with external 20 mil PVC coating and internal galvanized surface.
- D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.
 - 1. PVC coated conduit bodies and fittings for use with PVC coated conduit.

2.2 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. EMT: ANSI C80.3. galvanized tubing.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression type.

2.3 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: steel.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1.

2.4 PLASTIC CONDUIT AND FITTINGS

- A. Conduit: NEMA TC-2 Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC-3.

2.5 LIQUID-TIGHT FLEXIBLE CONDUIT AND FITTINGS

- A. Conduit: Flexible metal conduit with PVC jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1.

2.6 CONDUIT SUPPORTS

- A. Conduit Clamps, Straps, and Supports: Steel or malleable iron.
 - 1. PVC coated conduit clamps with 20 mil coating for use with PVC coated conduit and liquid-tight conduit.

2.7 FIRE STOP

- A. Fire stopping materials shall be NRTL listed to UL 1479 (ASTM E814). Installation methods shall conform to a UL fire stopping system. Submit specifications and installation drawings for the type of material to be used. Fire stopping materials shall be as manufactured by *3M, International Protective Coatings Corp., Specified Technologies, Inc., Carborundum Company, RayChem, Nelson Fire Stop* or approved equal.

2.8 EXPANSION JOINT FITTINGS

- A. Acceptable Manufacturers:
1. Thomas & Betts, XJG-TB series.
 2. Substitutions: Or Approved Equal.
- B. Pre-manufactured fittings constructed for malleable or ductile iron with exterior and interior zinc plating with a PVC external coating.
1. Fittings shall not require disassembly during installation.
 2. Fittings shall be rain-tight.
 3. Fittings shall include an internal copper braid bonding jumper as well as an external bonding jumper.

EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. Size conduit for conductor type installed, 3/4-inch minimum.
- B. Arrange conduit to maintain headroom and present a neat appearance.
- C. Route conduit parallel and perpendicular to walls and adjacent piping.
- D. Maintain minimum 6-inch clearance between conduit and heat sources such as flues, steam pipes and heating appliances.
- E. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
- F. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.
- H. Support conduit at spacing not to exceed the spacing allowed per ANSI 70.

3.2 CONDUIT INSTALLATION

- A. Cut conduit square using a saw or a pipecutter; de-burr cut ends.
- B. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- C. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.
- D. Install no more than the equivalent of three 90-degree bends between boxes.
- E. Use conduit bodies to make sharp changes in direction, as around beams.
- F. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 1-inch size.
- G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
- H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- I. Provide No. 12 AWG insulated conductor or suitable nylon pull rope in empty conduit, except sleeves and nipples.
- J. Install expansion joints along pier utility ramp structure and on side of pier, at not more than 100-foot intervals.
- K. Smoke and Fire Stopping Seals:
 - 1. Provide a seal around raceways or cables penetrating full height walls (slab to slab), floors or ventilation or air handling ducts so that the spread of fire or products of combustion shall not be substantially increased.
 - 2. Penetrations through fire-resistant-rated walls, partitions, floors or ceilings shall be fire stopped using approved methods and NRTL listed products to maintain the fire resistance rating.
 - 3. Installation restrictions of the listing agencies shall be strictly adhered to (e.g. 24 inch (610 mm) minimum horizontal separation between boxes on opposite sides of the wall, maximum square inch opening in wall).
 - 4. Fire stopping in sleeves or in areas having small openings that may require the addition or modification of installed cables or raceways shall be soft, pliable, non-hardening fire stop putty. Putty shall be water resistant and intumescent.
 - 5. Fire stopping in locations not likely to require frequent modification shall be a NRTL listed putty or caulk to meet the required fire resistance rating.
 - 6. Where conduit penetrates smoke partitions, seal opening around conduit with dry-wall joint compound or fire stop material.
- L. Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket.
- M. Do not install conduits within the poured-in-place floor slabs above grade.

- N. Where conduit(s) pass(es) from refrigerated or cooled atmosphere to warmer areas where condensation of water vapor may occur within raceways, conduit bodies sealed with "Duct Seal" type compound shall be provided after conductors are installed.
- O. Flexible conduit shall not exceed three (3) feet in length.
- P. Install top of underground conduit 30 inches (min.) below finished grade.
- Q. Slope exterior underground conduit away from building. Seal penetration around conduits entering the building.
- R. Use rigid galvanized steel conduit sweeps for underground elbows in conduit sizes 2 inch and larger.
- S. Provide PVC coated rigid conduit, fittings and support clamps for all conduit installed exposed on the pier or in the pier ramp utility chase. PVC coated liquid-tight flexible conduit shall be used for transitions where conduit leaves fixed grade and is fastened to pier structures.
- T. No exposed steel surfaces shall be left on conduit, conduit threads, or conduit fittings where PVC coated conduit is provided. Touch up all scratches and exposed steel with PVC compound as manufactured by the conduit manufacturer.

3.3 CONDUIT INSTALLATION SCHEDULE

- A. Underground Installations More Than Five Feet from Foundation Walls: Schedule 40 PVC plastic conduit.
- B. Installations Under Concrete Slab: Schedule 40 PVC plastic conduit (transition to rigid steel conduit where conduit rises above slab surface).
- C. Exposed Outdoor Locations: Rigid steel conduit (at grade locations).
- D. Exposed Outdoor Locations (at pier and at Roll-On/Roll-Off Ramp): PVC coated rigid steel conduit.
- E. Concealed Interior Locations: Electrical metallic tubing, or metal-clad cable as specified in Section 16123.
- F. Exposed Interior Locations (Mechanical and Electrical Rooms only): Electrical metallic tubing.
- G. Interior Motor Connections: Flexible metal conduit.
- H. Exterior Motor Connections: Liquid-tight flexible conduit.

END OF SECTION