

SECTION 16110

RACEWAYS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The work of this section consists of providing labor, material, tools, appliances and miscellaneous accessories associated with the raceways indicated by Drawings and schedules.
- B. Types of raceways in this section include the following:
 - 1. Electrical metallic tubing (EMT).
 - 2. Flexible metal conduit.
 - 3. Liquid-tight flexible metal conduit.
 - 4. Rigid metal conduit (RMC).
 - 5. Rigid nonmetallic conduit.

1.2 RELATED DOCUMENTS

- A. Drawings.
- B. General provisions of Contract, including General and Supplementary Conditions.
- C. Division 01 - Specification Sections.
- D. Section 16010 - General Electrical Provisions.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thickness) for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.
- B. Metal Conduit/Fittings:
 - 1. Rigid Steel Conduit: Provide zinc-coated, threaded type conforming to FS WW-C-581, ANSI C80.1 and UL 6.
 - 2. Rigid Metal Conduit Fittings: Cast malleable iron, hot dipped galvanized:
 - a. Use Type 1 fittings for rain tight connections.
 - b. Use Type 2 fittings for concrete tight connections.
 - c. Use Type 3 fittings for other miscellaneous connections.

C. Metallic Tubing/Fittings:

1. Electrical Metallic Tubing (EMT): FS WW-C-563 and ANSI C80.3 and UL 797 galvanized.
2. EMT Fittings: Heavy wall zinc plated steel setscrew type conforming to Federal Spec. WF-408d.

D. Flexible Conduit/Fittings:

1. Flexible Metal Conduit: FS WW-C-566 and UL 1. Formed from continuous length of spirally wound, interlocked zinc-coated strip steel.
2. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.
 - a. Straight Terminal Connectors: One-piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
 - b. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
3. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel, galvanized inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).
4. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G.

2.2 NONMETALLIC CONDUIT AND DUCTS

- A. Non-Metallic Conduit: Rigid PVC Schedule NEMA Stds Pub. No. TC-2.
- B. PVC Conduit Fittings: NEMA Stds Pub No. TC-3.

2.3 CONDUIT, TUBING AND DUCT ACCESSORIES: Provide conduit, tubing and duct accessories of types, sizes and materials, complying with manufacturer's published product information, which match conduit, tubing and ducts.

2.4 CONDUIT BODIES: Provide galvanized cast-metal conduit bodies of types, shapes, and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded-conduit-entrance ends, removable covers, either cast or of galvanized steel, and corrosion-resistant screws.

2.5 WIREWAYS: Provide electrical raceways of types, grades, sizes, weights (wall thickness), and number of channel, as indicated on drawings. Provide complete assembly of raceway including, but not necessarily limited to, couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other components and accessories as needed for complete system. Where types and grades are not indicated, provide proper selection as determined by installer to fulfill wiring requirements, and comply with applicable portions of NEC for electrical raceways.

PART 3 - EXECUTION

3.1 INSPECTION: Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways. Coordinate with other divisions to correct conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF RACEWAYS - GENERAL

- A. Install raceways as indicated; in accordance with manufacturer's written installation instructions, and in compliance with NEC, and NECA's "Standards of Installation". Install units plumb and level, and maintain manufacturer's recommended clearances.
- B. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.
- C. Install concealed conduits in new construction work, either in walls, slabs, or above hung ceilings. Run conduits concealed in existing work where practicable. Where conduits cannot be concealed in finished areas, use surface metal raceways.
- D. Mechanically fasten together metal conduits, enclosures, and raceways for conductors to form continuous electrical conductor. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.
- E. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
- F. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install standard expansion fittings in raceways every 200' linear run or wherever structural expansion joints are crossed, whichever is less.
- G. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.
- H. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.

3.3 INSTALLATION OF CONDUITS

- A. All conduit run exposed to weather and/or in wet or damp locations, shall be rigid threaded heavy wall steel conduit.

- B. All exterior conduit run underground shall be rigid threaded heavy wall steel or PVC Schedule 40. All underground conduits shall be encased in concrete envelope of 3" minimum thickness on all sides.
- C. When concrete envelope is specified on Drawings, the intent is that the concrete envelope is continuous throughout. **Where PVC is used slab or within walls, all elbows or bends greater than 12° shall be made with galvanized rigid conduit**, properly adapted to the PVC conduit.
- D. All interior conduit run in concrete slabs, or run beneath slab on grade or fill, and extending 5 feet beyond building perimeter, shall be rigid steel, Schedule 40 PVC or intermediate metal conduit (when permitted by NEC) and shall utilize fittings rated both "concrete tight" and "watertight".
- E. Interior conduit not installed in wet or damped locations and not subject to mechanical injury and sized 4" and smaller, may be electrical metallic tubing (EMT).

1. Flexible Conduit shall be used:

- a. In movable partitions
 - b. From outlet boxes to recessed lighting fixtures
 - c. For final 24" of connection to motors, transformers, or control items subject to movement or vibration
 - d. In cells of precast concrete panels.
2. May be used to serve devices and outlets within interior wood or metal stud partitions in non-assembly classifications.
3. Shall be liquid-tight flexible conduit where subjected to one or more of the following conditions:
- a. Exterior location.
 - b. Moist or humid atmosphere where condensate can be expected to accumulate.
 - c. Corrosive atmosphere.
 - d. Subjected to water spray or dripping oil, water or grease, this would include kitchen areas, mechanical areas, etc.

F. Methods of Installation:

- 1. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.
- 2. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
- 3. Size conduits to meet NEC, except no conduit smaller than 3/4 inch shall be embedded in concrete or masonry. Maximum 3 branch circuits shall be allowed in 1/2" conduit. Contractor responsible for sizing conduit to accommodate pulling tensions due to bends in conduits.

4. Fasten conduit terminations in sheet metal enclosures by 2 locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.
5. Conduits are not to cross pipe shafts, or ventilating duct openings.
6. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.
7. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
8. Support riser conduit at each floor level with clamp hangers.
9. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.
10. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
11. Provide nylon pull cord in empty conduits where indicated. Test conduits required to be installed, but left empty, with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.
12. Concealed Conduits:
13. Metallic raceways installed underground or in floors below grade, or exposed outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure water tightness.
14. Install underground conduits minimum of 24" below finished grade.

G. Conduits in Concrete Slabs:

1. Place conduits between bottom reinforcing steel and top reinforcing steel.
2. Place conduits either parallel, or at 90 degrees, to main reinforcing steel.
3. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
4. Conduits crossing in slab must be reviewed for proper cover by Engineer.
5. Embedded conduit diameter is not to exceed 1/3 of slab thickness. All conduit installation work in slab to be coordinated with Division 1 to insure this criterion is met. Any adjustment to accommodate the work is the responsibility of the Contractor.
6. Conduit shall have a minimum concrete cover of 3/4".

H. Exposed Conduits:

1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
2. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
3. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed following: up to 1": 6'-0"; 1-1/4" and over: 8'-0".
4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.

5. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.
6. Non-Metallic Conduits:
 - a. Make solvent-cemented joints in accordance with recommendations of manufacturer.
 - b. Install PVC conduits in accordance with NEC and in compliance with local utility practices.
7. Conduit Fittings:
 - a. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
 - b. Bushings for terminating conduits smaller than 1-1/4" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.
 - c. Install insulated type bushings for terminating conduits 1-1/4" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
 - d. Bushing of standard or insulated type to have screw type grounding terminal.

END OF SECTION