

SECTION 16110 – “CONDUIT”

This section is intended to define the general installation requirements for the conduit systems installed at the University of Pennsylvania.

The National Electrical Code shall govern the actual sizing of conduit during the design process. Minimum design conduit sizing shall accommodate type XHHW insulated wire.

- 1.0 Conduit shall be identified in accordance with Section 16195 – “Electrical Identification”.
- 2.0 Each electrical system, such as lighting (277 volt), receptacle (120 volt), emergency lighting, fire alarm system, telephone/data system, Building Automation System, security system, and CCTV system, shall be routed in a dedicated conduit system.
- 3.0 Conduits shall be designed to run parallel with the lines of the building. Electrical conduits shall not be hung on hangers with any other service pipes, ducts, or other systems and shall be supported independent of any ceiling support systems. Related conduits shall be grouped together and supported from a conduit rack; provide space on rack for 25 percent additional conduits. Refer to Section 16190 for additional supporting requirements.
- 4.0 Rigid steel fittings shall be of the threaded type only; EMT fittings shall be of the compression type in mechanical and electrical equipment rooms; EMT fittings with set screws are permitted elsewhere
- 5.0 Exposed raceways shall be installed above water and steam piping. Maintain a minimum 12 inches clearance between conduit and surfaces with temperatures exceeding 104 degree F.
 - A. Maintain a minimum clearance of at least 6 inches between power conduits and telecommunications conduits and at least 12 inches between power conduits and unshielded twisted-pair telecommunications cables or as required by EIA/TIA Standard 569.
- 6.0 Raceway shall be designed with expansion joints to allow for thermal expansion of conduit system and of the building (at expansion joints) and keep stresses within the allowable limits of the conduit.
- 7.0 Junction/pull boxes shall be located to facilitate installation of cables and insure that the pulling tension of cables is not exceeded. However, install no more than the equivalent of (3) 90-degree bends between boxes.

- 8.0 Conduit and support systems shall be designed to meet applicable seismic codes.
- 9.0 Lateral installation of conduit on rooftops is not permitted.
- 10.0 In general, conduit sizes and types shall be suitable for the applications. The following is a summary of minimum conduit requirements.
- A. All conduits shall be a minimum 3/4 inch.
 - B. Underground Installations:
 - 1. Concrete encased ductbanks under roadways, parking lots, or other areas subject to vehicular traffic: Use schedule 40 PVC conduit; ductbank shall be steel reinforced
 - 2. Concrete encased ductbanks under all other area:
 - a. More than five feet from foundation wall or outdoor equipment pads: Use schedule 40 PVC.
 - b. Within five feet of foundation wall or outdoor equipment pads. Use rigid steel conduit.
 - 3. Direct Burial Branch circuit wiring for lighting, pumps, receptacles, etc.: Use Schedule 40 PVC conduit.
 - 4. Installation of conduits under slab on grade is strictly prohibited. Only service entrance feeders shall be permitted to be installed under slab. All feeders within the building will be served by raceway systems installed within the structure.
 - 5. Duct banks and conduit shall be installed above water and steam piping. Maintain a minimum 6-foot clearance between underground conduit or duct banks and any parallel steam lines. Underground crossings above steam lines shall maintain a minimum 24-inch clearance to be filled with foam glass insulation.
 - C. In slab, above grade:
 - 1. The installation of conduit in slab is prohibited.
 - D. Outdoor Locations, Above Grade: In corrosive environments, use 40 MIL thick PVC coated rigid steel conduit with PVC coated threaded fittings; otherwise rigid steel conduit.
 - E. Wet and Damp Locations: In corrosive environments, use 40 MIL thick PVC coated rigid steel with PVC coated threaded fittings; otherwise use rigid steel conduit. All

roof conduit penetrations shall use PVC coated rigid steel conduit.

F. Dry Locations:

1. Switchboard and panelboard feeders: EMT.
2. Feeders or branch circuits 100 amps and larger: EMT.
3. Circuits operating above 600V: Rigid steel conduit.
4. Exposed conduit in finished areas: Coordinate with Architect.
5. Exposed conduit in non-finished areas (equipment rooms, storage rooms, etc.): Use EMT with compression fittings except RGS up to 8 feet above finished floor.
6. Equipment Rooms: Install rigid steel conduit in rough-use areas like mechanical and electrical equipment rooms, janitor's closets, etc.
7. Conduits in exterior walls: Rigid steel conduit.
8. Conduit in Interior Walls: Electrical metallic tubing.
9. Above False Ceiling: Electrical metallic tubing or MC cable with insulated ground conductor.

G. Hazardous Locations: Use galvanized rigid steel conduit.

H. Battery Storage Rooms: Rigid conduit.

I. Metal Clad (MC) Cable Installations

1. Type MC cable installation shall be in accordance with the following:
No more than nine (9) total current-carrying conductors in multiple MC cable runs shall be bundled together into a single MC cable hanger. Wireway or ladder type tray with dual supports may also be used to support MC cable with fill as allowed by the NEC. Neutrals shall be counted as current-carrying conductors.
2. MC cable shall be run parallel or perpendicular to walls. No diagonal runs shall be permitted.
3. Maintain a clearance of at least 6 inches from hot water and other high-temperature pipes and telecommunications conduits, and at least 12 inches from unshielded twisted-pair telecommunications cables.
4. The arrangement of MC cables and fastening methods shall be subject to the approval of the Owner. Securely support all MC cable with cable hangers, individual spring steel support clips, steel trapeze hangers, threaded rods or dedicated No. 8 AWG drop wires. Cable supports shall be fastened to concrete slabs, beams, joists or other structural members of the building. Do not support MC cable on hung ceilings or on ceiling support wires. The use of cable ties to support MC cable is prohibited.

5. Support MC cable every 6 feet and within 1 foot of every box, panelboard, fitting, or cable termination.
 6. All MC cables passing through fire-rated walls or electrical/telecommunications room walls shall be provided with a UL-listed, fire-rated penetration assembly.
- J. Flexible Metal Conduit:
1. Provide flexible conduits for connections to motors, transformers, and other electrical equipment when it is subject to movement, vibration, misalignment, cramped quarters or where noise transmission is to be eliminated or reduced. Do not use flexible non-metallic conduit. Flexible conduit shall be of the liquid-tight type when installed under any of the following conditions:
 - a. Exterior locations.
 - b. Moisture or humidity laden atmospheres where it is possible for condensation to accumulate.
 - c. Corrosive atmospheres.
 - d. Where water or spray due to wash-operations is frequent or possible.
 - e. Wherever there is a possibility of seepage or dripping of oil, grease or water.
 - f. Connections to pumps.
- K. All other applications not specified herein, use rigid steel conduit.
- L. Paint all medium voltage conduit and junction boxes red and identify with voltage.

END OF SECTION