

SECTION 260533 – CONDUIT

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

For underground conduits, refer to section 260502 for excavation and backfill requirements.

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 260553 – “Electrical Identification”.
- 2.0 Each electrical system, such as lighting (480/277 volt), receptacle (208/120 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 supported on hangers with any other services, pipes, ducts, or other mechanical systems and shall be supported independently 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 260528 for additional supporting requirements.
- 4.0 Rigid steel conduit fittings shall be of the threaded type. Zinc based cast fittings are not permitted. Use cast iron or cast steel.
- 5.0 EMT conduit fittings shall be of the compression type.
- 6.0 Fittings for non-metallic conduit systems shall be compatible with the conduit material and type and shall be suitable for use with the required adhesives.
- 7.0 Exposed conduit (or other raceways) shall be installed above water and steam piping. Maintain a minimum 12 inches clearance between conduit and all piping systems with fluid 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.
- 8.0 Conduit (or other raceways) shall be designed and installed with expansion joints to allow for thermal expansion of conduit system and movement of the building (at expansion joints) and keep stresses within the allowable limits of the conduit. Expansion joints shall be located as per NEC requirements and, as a minimum, at all building expansion joints. Expansion joints shall allow for the required amount of movement in order to prevent buckling of conduit or pullout at fittings.
- 9.0 Junction/pull boxes (or suitable conduit fittings) 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 pull boxes or fittings. Junction/pull boxes and conduit fittings shall be located so that the capability for future access is maintained. Junction/pull boxes shall not be located on building expansion joints.

- 10.0 Conduit shall be installed so that access to equipment, systems, piping, etc. is not blocked by the conduit.
- 11.0 Conduit and support systems shall be designed to meet applicable seismic codes.
- 12.0 Lateral installation of conduit on rooftops is not permitted except as required to serve rooftop equipment.
- 13.0 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: Refer to Section 260543.
 - C. In slab, above grade: The installation of conduit in above grade concrete slabs is prohibited.
 - D. Outdoor Locations, Above Grade: In corrosive environments, use PVC coated rigid steel conduit and compatible fittings. In non-corrosive environments, use rigid steel conduit.
 - E. Wet and Damp Locations: In corrosive environments, use schedule PVC coated rigid steel conduit and compatible fittings. In non-corrosive environments, use rigid steel conduit. All roof conduit penetrations shall use rigid steel conduit.
 - F. Dry Locations:
 - 1. Switchboard and panelboard feeders: EMT or RGS.
 - 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 not subject to damage: EMT.
 - 6. Exposed conduit in non-finished areas subject to damage: RGS.
 - 7. Equipment Rooms (mechanical and electrical equipment rooms, janitor's closets, etc.): RGS.
 - 8. Conduits in exterior walls: RGS.
 - 9. Conduit in Interior Walls: EMT.
 - 10. Above False Ceiling: EMT or MC cable with insulated ground conductor. Limit MC to 8' lengths for whips to light fixtures and wiring devices.
 - 11. Rooftop locations: RGS
 - G. Hazardous Locations: RGS.
 - H. Battery Storage Rooms: RGS. All DC system conduits shall be labeled as DC system and shall identify polarity (+ or -)
 - 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. (Not necessary in three phase feeders)

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 University Engineering Department. 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, or on HVAC ducts, piping, etc. The use of cable ties to support MC cable is prohibited.
 5. Support MC cable every 3 feet and within 1 foot of every box, enclosure, 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 metallic 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 metallic 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.
 - g. Maximum allowable length is 18".
- K. All other applications not specified herein, use RGS conduit.
- L. Paint all medium voltage conduit and junction boxes red and identify with voltage label.
- M. Seal raceways passing from warm to cold locations, such as in cold storage rooms or where passing from the interior to the exterior of a building, or where otherwise required by the NEC. Fill with listed sealing compound to prevent circulation of warm air to colder section of raceway.
- N. Conduits threaded in the field shall be coated with an approved electronically conductive, corrosion resistant compound.