

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

- A. Bedding of conduits: Section 31 20 00, EARTH MOVING.
- B. General electrical requirements and items that is common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.3 SUBMITTALS

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

- A. Shop Drawings:
 - 1. Size and location of main feeders
 - 2. Size and location of pull boxes
 - 3. Layout of required conduit penetrations through structural elements.
 - 4. The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Certification: Prior to final inspection, deliver to the COR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):
 - 70-08.....National Electrical Code (NEC)
- C. Underwriters Laboratories, Inc. (UL):
 - 6-07.....Rigid Metal Conduit
 - 50-07.....Enclosures for Electrical Equipment

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- 360-09.....Liquid-Tight Flexible Steel Conduit
- 467-07.....Grounding and Bonding Equipment
- 514A-04.....Metallic Outlet Boxes
- 514B-04.....Fittings for Cable and Conduit
- 651-05.....Schedule 40 and 80 Rigid PVC Conduit
- D. National Electrical Manufacturers Association (NEMA):
 - TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and
Tubing
 - FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies
for Conduit, Electrical Metallic Tubing and
Cable

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Conduit Size: In accordance with the NEC, but not less than 26 mm
(1 inch) unless otherwise shown.
- B. Conduit:
 - 1. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
 - 2. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
 - 3. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A,
heavy wall PVC.
- C. Conduit Fittings:
 - 1. Rigid steel conduit fittings:
 - a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA
FB1.
 - b. Standard threaded couplings, locknuts, bushings, and elbows: Only
steel or malleable iron materials are acceptable. Integral
retractable type IMC couplings are also acceptable.
 - c. Locknuts: Bonding type with sharp edges for digging into the metal
wall of an enclosure.
 - d. Bushings: Metallic insulating type, consisting of an insulating
insert molded or locked into the metallic body of the fitting.
Bushings made entirely of metal or nonmetallic material are not
permitted.
 - e. Erickson (union-type) and set screw type couplings: Approved for
use in concrete are permitted for use to complete a conduit run
where conduit is installed in concrete. Use set screws of case
hardened steel with hex head and cup point to firmly seat in
conduit wall for positive ground. Tightening of set screws with
pliers is prohibited.

- f. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
- 2. Liquid-tight flexible metal conduit fittings:
 - a. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
 - b. Only steel or malleable iron materials are acceptable.
 - c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- 3. Direct burial plastic conduit fittings:
 - a. Fittings shall meet the requirements of UL 514C and NEMA TC3.
 - b. As recommended by the conduit manufacturer.
- 4. Expansion and deflection couplings:
 - a. Conform to UL 467 and UL 514B.
 - b. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
 - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
 - 1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
 - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
 - 3. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1 1/2 by 1 1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
 - 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
 - 1. UL-50 and UL-514A.
 - 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

3. Sheet metal boxes: Galvanized steel, except where otherwise shown.

F. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape non-detectable type, red with black letters, and imprinted with "CAUTION BURIED ELECTRIC LINE BELOW".

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

COR1. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COR as required by limited working space.

B. Waterproofing: At exterior conduit penetrations, completely seal clearances around the conduit and make watertight.

3.2 INSTALLATION, GENERAL

A. In accordance with UL, NEC, as shown, and as hereinafter specified.

B. Install conduit as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
4. Mechanically and electrically continuous.
5. Independently support conduit at 8'0" on center. Do not use other supports.
6. Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
7. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
8. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.

C. Conduit Bends:

1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

D. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown.

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2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COR.

3.3 DIRECT BURIAL INSTALLATION

- A. Exterior routing of circuits (600 volts and less):
 1. Pre-coated rigid galvanized steel conduit in accordance with the requirements of Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

3.4 MOTORS AND VIBRATING EQUIPMENT

- A. Provide liquid-tight flexible metal conduit for installation in exterior locations.

3.5 CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- C. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- D. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- E. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- F. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- G. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.6 BOX INSTALLATION

- A. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- B. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

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