# SECTION 260534 CONDUITS, BOXES, AND FITTINGS

## PART 1 - GENERAL

A. Description

This section includes material, installation, and testing for conduit, boxes, and fittings.

B. Related Work Specified Elsewhere

1. General Electrical Requirements: 260500.

2. Grounding and Bonding: 260526.

3. Trenching, Backfilling, and Compacting: 312316.

C. Submittals

1. Submit shop drawings in accordance with the General Conditions and Section 260500.

2. Submit product data for the following:

   a. Fittings.

   b. Conduit and fittings for each type specified.

   c. Boxes.

D. Quality Control

1. NEMA Compliance: Comply with NEMA standards pertaining to conduits and components.

2. UL Compliance and Labeling: Comply with requirements of UL standards pertaining to electrical conduits and components. Provide conduits and components listed and labeled by UL.

## PART 2 - MATERIALS

A. Rigid Steel Conduit and Fittings

1. Rigid Steel Conduit and Fittings: Conform to ASME C80.1, NEMA RN2, and UL 6, hot-dipped galvanized after threading. The zinc coating shall be flexible and not crack during bending.

2. Fittings:

   a. Locknuts: Steel or malleable iron.

   b. Bushings: Threaded type, steel or malleable iron, with 105°C rated plastic insulated throat. Plastic bushings with a temperature rating of 105°C may be used for conduits 1 inch and smaller.

   c. Box Connectors for Damp and Wet Locations: Provide a watertight threaded hub on enclosure consisting of sealing fitting with tapered conduit thread, neoprene O-ring, and 105°C rated insulating throat with grounding and bonding lug.

   d. Couplings: Threaded, hot-dipped galvanized after fabrication.

3. Long-Radius Elbows (90 Degrees):

| **Conduit Size (inches)** | **Minimum Radius (inches)** |
|---|---|
| 3/4 through 1 1/4 | 12 |
| 2 and 2 1/2 | 15 |
| 3 and 3 1/2 | 18 |

B. Rigid Nonmetallic Conduit (PVC) and Fittings

1. Conduit: PVC Schedule 40, 90°C rise rating, conforming to NEMA TC-2 Type EC-40 and UL 651.

2. Long-Radius Elbows (90 Degrees): Rigid PVC-coated conduit of the same dimension as specified for steel conduit.

3. Couplings, Adapters, End Bells, Expansion Couplings, Elbows, and Turns of 30 Degrees: Factory-made in accordance with NEMA TC-2 and TC-3.

4. Joint Cement: As recommended by manufacturer as suitable for the climate, furnished with instructions to achieve watertight joints.

5. Manufacturers: Carlon, Condux, or equal.

C. Liquid-Tight Flexible Metal Conduit and Fittings

1. Conduit: Steel, UL 360 listed, PVC jacketed.

2. Fittings:

   a. Conform to ASME C33.84, UL listed for use with the conduit.

b. In sizes 1 1/4 inches and less, UL listed for grounding.

c. Made of steel or malleable iron, zinc plated, 105°C insulated throat, grounding and bonding lug.

D. Conduit Bodies

1. Provide types, shapes, and sizes to suit individual applications. Provide matching gasketed covers, secured with at least two captive corrosion-resistant screws.

2. Bodies connecting to rigid conduit shall be of the same material and material coating as the conduit, with metal threaded hubs. Provide with threaded covers or gasketed covers secured with at least two corrosion-resistant captive screws.

3. Connect bodies to electrical metallic tubing with compression-type EMT connectors.

4. Bodies connecting to nonmetallic conduit shall be nonmetallic conduit bodies conforming to UL 514B.

E. Outlet Boxes

1. Exposed Boxes:

a. Cast iron or aluminum, with threaded hubs.

b. Conduit bodies may be used instead of boxes except where boxes contain devices.

F. Junction and Pull Boxes

1. Provide factory-made standard sizes, and shop fabricate when nonstandard size boxes are shown or are required. Comply with UL and NEMA standards.

2. NEMA 4: Code gauge steel, hot-dipped galvanized after fabrication. Provide cover with Type 303 stainless steel bolts.

G. Conduit Sealant

1. Moisture Barrier Types: Sealant shall be a nontoxic, nonshrink, nonhardening, putty-type hand-applied material providing an effective barrier under submerged conditions.

2. Fire-Retardant Types: Fire stop material shall be a reusable, nontoxic, asbestos-free, expanding, putty-type material with a three-hour rating in accordance with UL 35L4.

PART 3 - EXECUTION

A. Conduit Usage Schedule

Install the following types of conduits and fittings in locations listed, unless otherwise noted in the drawings. Definitions and requirements of NEC apply unless specifically modified below. Refer to Section 260500 for definitions of locations.

1. Exterior, Exposed:

   a. Material: Rigid steel conduit.

   b. Minimum Size: 3/4 inch.

2. Exposed, Dry, Wet, and Damp Locations:

   a. Material: Rigid steel conduit.

   b. Minimum Size: 3/4 inch.

3. Embedded in Concrete:

   a. Material: Rigid steel conduit.

   b. Minimum Size: 3/4 inch.

4. In Earth, Below Concrete Slabs or Underground:

   a. Material: Rigid nonmetallic conduit (PVC).

   b. Minimum Size: 3/4 inch.

   c. Conduit Stub-Ups: Provide PVC-coated rigid steel conduit long-radius elbows for stub-ups which connect to underground rigid PVC conduit. Extensions from elbows above grade shall be PVC-coated rigid steel for a minimum of 6 inches above grade. Stub-ups into free-standing electrical gear, such as power pedestal, may be Schedule 80 rigid PVC conduit, in which case terminate the conduits with appropriate end bells.

5. Final Connections to Motors, Transformers, Vibrating Equipment, or Instruments:

   a. Material: Liquid-tight flexible conduit.

   b. Minimum Size: 1/2 inch.

c. Length of liquid-tight flexible conduit shall be 5 feet or less, unless field conditions require longer lengths.

B. Junction and Pull Boxes--Usage Schedule

Install the following type of boxes in locations listed, unless otherwise noted in the drawings. Refer to Section 260500 for definitions of locations:

1. Exterior: NEMA 4.

2. Interior, Damp: NEMA 4.

C. Conduit Fill

For runs that are not sized in drawings, compute the maximum conduit fill using NEC requirements for Type THW conductors (larger if applicable), although the actual wiring may be with types of conductors having smaller cross-sections.

D. Conduit Installation, General

1. Install conduit concealed unless specifically noted otherwise.

2. Run exposed conduits parallel and perpendicular to surface or exposed structural members and follow surface contours as much as practicable to provide a neat appearance.

3. Make right-angle bends in conduit runs with long-radius elbows or conduits bent to radii not less than those specified for long-radius elbows.

4. Make bends and offsets so that the inside diameter of conduit is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

5. Cap all conduits immediately after installation to prevent entrance of foreign matter.

6. Do not use diagonal runs except when specifically noted in the drawings.

7. Route exposed conduit to preserve headroom, access space, and work space.

8. Treat threaded joints of rigid steel conduit with T&B "Kopr-Shield" before installing fittings where conduit is in slabs and other damp or corrosive areas.

9. Conduit Terminations:

   a. Terminate conduits with locknuts and bushings except where threaded hubs are specified.

b. Install conduits squarely to the box and provide one locknut outside the box and one locknut and bushing inside the box.

c. Install locknuts with dished side against the box.

d. When terminating in threaded hubs, screw the conduit or fitting tight into the hub so that the end bears against the fire protection shoulder.

e. When chase nipples are used, install conduits and coupling square to the box and tighten the chase nipple leaving no exposed threads.

10. Install exposed, parallel, or banked conduits together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel.

11. Conduit runs are shown schematically. Supports, pull boxes, junction boxes, and other ancillary equipment are not usually shown in drawings. If not shown, provide as required by NEC except that there shall not be more than the equivalent of three quarter bends (270 degrees) total between underground pull points. Provide additional boxes to permit pulling of wires without damage to the conductors or insulation.

12. Locations of conduit stub-ups shown in the drawings are schematic. Coordinate these locations with conduit entries of actual equipment served.

E. Requirements for Rigid Nonmetallic (PVC) Conduit

1. Comply with the installation provisions of NEMA TC-2, except as modified below.

2. Make cuts with a fine tooth handsaw. For sizes 2 inches and larger, use a miter box or similar saw guide to assure a square cut.

3. Use factory-made couplings for joining conduit.

4. Cementing and joining operation shall not exceed 20 seconds. Do not disturb joint for 5 minutes, longer (up to 10 minutes) at lower temperatures. Make joints watertight. Joining procedure shall conform to the procedures of ASTM D2855.

5. Install expansion fittings. Expansion fittings are required when the conduit is left exposed in trenches for a period of time during which the conduit's temperature can vary more than 2 degrees. Install expansion fittings near the fixed end of the run and 100 feet on center.

F. Conduit Sealing

Seal conduit entries with conduit sealant where conduits exit buildings underground structures.

G. Grounding

1. Provide grounding in accordance with Section 260526.

2. Use grounding bushings for all conduits carrying a grounding conductor.

3. Provide a grounding conductor in flexible conduit, size conforming to NEC Article 250.

H. Conduits Embedded in Concrete and Below Slabs

1. Install conduits and sleeves passing through slabs, walls, columns, or beams so as not to impair the strength of construction. Secure conduit to prevent sagging or shifting during concrete pour.

2. Conduits larger than 1 1/2 inches in diameter may be embedded in structural concrete only after submittal and review of location and reinforcement details.

3. Conduits and sleeves may be installed without specific permission, provided:

   a. They are 1 1/2 inches or less in diameter, are spaced not less than three diameters on centers, and conform to paragraph b or c below.

   b. Conduits, including fittings, which are embedded within a column, do not displace more than 4% of the cross-sectional area on which structural strength is calculated.

   c. Conduits and sleeves, embedded within a wall, slab, or beam, are not larger in the outside dimension than one-third the overall thickness of wall, slab, or beam in which they are embedded.

   d. There is a minimum of 1 1/2 inches between the conduit and reinforcement for slab and wall penetrations.

4. Install conduits in slabs other than slabs-on-grade as close to the middle of the slabs as practical without disturbing the reinforcement. Outside diameter of the conduit shall not exceed one-third times the slab thickness. Do not space parallel runs of conduit closer than three diameters on centers, except at cabinet and outlet box locations.

5. Conduits shown in or under slab-on-grade construction shall be installed below the floor slab and under curing or damp-proofing membranes. An exception may be made for conduit with an outside diameter not larger than 25% of the slab thickness, in which case, standards applying to slabs other than slab-on-grade may be used.

6. Install expansion fittings at expansion joints.

I. Conduits Underground

Where PVC conduit is installed underground in locations other than under concrete slab, provide 24-inch minimum cover. Provide 3-inch minimum sand above and below conduits as specified in Section 312316. Maintain a 12-inch minimum separation between conduit and other systems. Pitch conduit to drain away from power pedestal.

J. Conduit Supports

1. Support conduit at intervals and at locations as required by the NEC. Do not use perforated strap or plumber’s tape for conduit supports.

2. Conduit on Concrete or Masonry: Use one-hole malleable iron clamps with pipe spacers (clamp backs) or preformed galvanized steel channels. Anchor with metallic expansion anchors and screws or from preset inserts. Use preset inserts in prestressed concrete. On plaster or stucco, use one-hole malleable iron straps with toggle bolts.

K. Damaged Conduit

1. Repair or replace conduit damaged during or after installation.

2. Replace crushed or clogged conduit or any conduit whose inner surface is damaged or not smooth.

3. Repair cuts, nicks, or abrasions in the zinc coating of galvanized conduit with galvanizing repair stick, Enterprise Galvanizing "Galvabra" or equal.

4. Repair cuts, nicks, or abrasions in the PVC coating of PVC-coated conduit with the manufacturer's recommended PVC material and build up surface thickness to match the factory coating thickness and color.

L. Empty Conduit

1. Provide 200-pound strength pull cord in all empty conduits.

2. Provide a waterproof label on each end of the pull cords to indicate the destination of the other end.

M. Equipment Supports

Support wall-mounted junction boxes, pull box enclosures, and panels in damp and wet locations with Type 304 stainless steel preformed channels and Type 304 stainless steel concrete anchors.

N. Adjusting and Cleaning

Upon completion of installation of conduits and boxes, inspect interiors of conduits and boxes; clear blockages; and remove burrs, dirt, and construction debris.

END OF SECTION