**SECTION 260533-RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.1 SUMMARY

A. Section includes conduit raceways, and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Conduit fittings.

1.2 REFERENCES AND QUALITY ASSURANCE

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI C80.5 - Rigid Conduit.

D. UL 360– Liquid tight metal conduit

E. NEMA TC9 – PVC 40 AND 80

F. NECA (National Electrical Contractor’s Association) - "Standard of Installation"

G. NEMA FB 1 (National Electrical Manufacturers Association) - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

H. NEMA OS 1 (National Electrical Manufacturers Association) - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

I. NEMA OS 2 (National Electrical Manufacturers Association) - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

J. NEMA RN 1 (National Electrical Manufacturers Association) - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

K. NEMA TC 3 (National Electrical Manufacturers Association) - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

L. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum).

M. NFPA 70 – National Electrical Code.

N. Underwriter’s Laboratory (UL)

O. UL 514A

P. Canadian Standard Association (CSA)

Q. Intermediate Metal Conduit (IMC) UL 1242.

R. Liquidtight Flexible Metal Conduit UL 360.

S. Underground Polyvinul Chloride (PVC) Nema TC9.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground More than 5 feet outside Foundation Wall: Provide schedule 40 nonmetallic conduit encased in concrete, 3" all sides. Provide cast metal boxes or nonmetallic handhole.

C. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit encased in concrete, 3" all sides. Provide cast metal or nonmetallic boxes. Use rigid metal sweeping 90 degree elbows when entering building from below grade.

D. Under Slab on Grade: Provide Schedule 40 nonmetallic conduit. Provide cast metal boxes. Prodive GRC 90's and risers through the slab.

E. Outdoor Locations, Above Grade: Provide rigid steel. Provide cast metal outlet, pull, and junction boxes.

F. In Slab Above Grade: Provide schedule 40 nonmetallic conduit. Provide cast metallic boxes.

G. Wet and Damp Locations: Provide rigid steel metal conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

H. Concealed Dry Locations: Provide electrical metallic tubing with steel set screw fittings. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

I. Exposed Dry Locations: electrical metallic tubing with steel set screw fittings. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

J. PVC Schedule 40 conduit may be for exterior branch circuits. Encase PVC Schedule 40 conduit in 3 inch concrete when under drives and parking areas.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for the following:
1. Liquidtight flexible metal conduit.
2. Nonmetallic conduit.
3. Flexible nonmetallic conduit.
4. Nonmetallic tubing.
5. Raceway fittings.
6. Conduit bodies.
7. Surface raceway.
8. Wireway.
9. Pull and junction boxes.
10. Handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Section 017700 - Closeout procedures.

B. Project Record Documents:
1. Record actual routing of conduits larger than 2 inch trade size.
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 METAL CONDUIT RACEWAY

A. Manufacturers:
1. Allied.
2. Wheatland
3. Republic
4. The Wiremold Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. Rigid Aluminum Conduit: ANSI C80.5.

D. Intermediate Metal Conduit (IMC): Rigid steel.

E. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.2 FLEXIBLE METAL CONDUIT

A. Manufacturers:
1. Carlon Electrical Products.
2. Panduit
3. Thomas & Betts Corp.

B. Product Description: Interlocked steel construction.

C. Fittings: NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:
1. Carlon Electrical Products.
2. Panduit
3. Thomas & Betts Corp.

B. Product Description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied.
2. Wheatland
3. Republic
4. The Wiremold Co.

B. Product Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel, compression type.

2.5 NONMETALLIC CONDUIT

A. Manufacturers:
1. Carlon Electrical Products.
2. Allied
3. Queen City

B. Product Description: NEMA TC 2; Schedule 40 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

## 2.6 WIREWAY

A. Manufacturers:
1. Carlon Electrical Products.
2. Walker Systems Inc.
3. The Wiremold Co.

B. Product Description: General purpose, Oiltight and dust-tight, Raintight type wireway as required.

C. Knockouts: As required.

D. Size: 4 x 4 inch, 6 x 6 inch, 8 x 8 inch, and 12 x 12 inch; length as indicated on Drawings.

E. Cover: Hinged cover with full gaskets.

F. Connector: Slip-in or Flanged as required.

G. Fittings: Lay-in type with removable side; captive screws, drip shield.

H. Finish: Rust inhibiting primer coating with gray enamel finish.

I. 16 gauge galvanized construction with ANSI-49 epoxy gray paint.

J. Sufficient size to accommodate all cables and wires installed.

K. NEMA 12 rating on interior of building.

L. NEMA 4 water and oil tight and exterior locations

## 2.7 OUTLET BOXES

A. Manufacturers:
1. Carlon Electrical Products.
2. RACO
3. Steel City
4. Walker Systems Inc.
5. The Wiremold Co.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

C. Nonmetallic Outlet Boxes: NEMA OS 2.

D. Cast Boxes: NEMA FB 1, Type FS, cast feralloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

E. Wall Plates for Finished Areas: As specified in Section 262726.

F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

G. Minimum depth for boxes is 2 inches, date/video and voice are to be 2 gang and 3 ½ inches minimum depth.

## 2.8 PULL AND JUNCTION BOXES

A. Manufacturers:
1. Carlon Electrical Products.
2. RACO.
3. Steel City
4. Walker Systems Inc.
5. The Wiremold Co.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Screw Cover Enclosures: As specified in Section 16131.

D. Surface Mounted Cast Metal Box: NEMA 250, Type 1; flat-flanged, surface mounted junction box:
1. Material: Galvanized cast iron.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

E. In-Ground Cast Metal Box: NEMA 250, Type 6, inside flanged, recessed cover box for flush mounting:
1. Material: Galvanized cast iron.
2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
3. Cover Legend: "ELECTRIC".

F. Fiberglass Concrete composite Handholes: Die-molded, glass-fiber concrete composite hand holes:
1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
2. Cover: Glass-fiber concrete composite, weatherproof cover with nonskid finish.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Refer to Division 1 requirements.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

## 3.2 INSTALLATION

A. Install Work in accordance with State Ohio standards.

B. Install raceway and boxes in accordance with NECA "Standard of Installation."

C. Ground and bond raceway and boxes in accordance with Section 260526.

D. Fasten raceway and box supports to structure and finishes in accordance with Section 260529.

E. Identify raceway and boxes in accordance with Section 260553.

F. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 260529; provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 260529.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit under slab from point-to-point.

K. Maximum Size Conduit in Slab Above Grade: 3/4 inch. Do not cross conduits in slab.

L. Maintain clearance between raceway and piping for maintenance purposes.

M. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

N. Cut conduit square using saw or pipe cutter; de-burr cut ends.

O. Bring conduit to shoulder of fittings; fasten securely.

P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

Q. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

R. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams.

S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

T. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

U. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

V. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

W. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

X. Close ends and unused openings in wireway.

Y. Install underground conduits a minimum of 36 inches below finished grade.

Z. Install below slab conduits a minimum of 12 inches below the slab.

AA. EMT may be used in the interior of the building in dry locations; PVC 40 installed 6 inches below the slab with GRC turn ups through the slab may be used; wet locations and exposed to potential damage are to be GRC; PVC 40 in masonry walls may be used. Exterior underground conduits used for feeders shall be concrete encased with a 4 inch envelope a minimum of 36 inches below grade and shall be PVC 40. Exterior underground conduits used for branch circuits shall be premium fill encased with a 4 inch envelope, except proved a 4 inch concrete envelope under drives and parking areas, a minimum of 36 inches below grade and shall be PVC 40.

BB. Each conduit shall have an equipment ground conductor sized in accordance with the NEC.

CC. Raceways shall be concealed unless otherwise noted.

## 3.4 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 262726.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

## 3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified in other sections

C. Locate outlet boxes to allow luminaires positioned as indicated on architectural reflected ceiling plan.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

## 3.6 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

## 3.7 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 260533