SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
   1. Raceways include following:
      a. RMC.
      b. PVC externally coated, rigid steel conduits.
      c. EMT.
      d. FMC.
      e. LFMC.
      f. RNC.
      g. Surface raceways.
   2. Boxes, enclosures, and cabinets include following:
      a. Device boxes.
      b. Outlet boxes.
      c. Pull and junction boxes.
      d. Cabinets and hinged-cover enclosures.

B. Related Sections:
   1. Section 26 05 11 - Requirement for Electrical Installation.
   2. Section 26 05 21 – Low Voltage Electrical Power Conductors and Cables (600V and below.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. LFMC: Liquidtight flexible metal conduit.

D. RMC: Rigid metal conduit.

E. RNC: Rigid nonmetallic conduit.

1.3 SUBMITTALS

A. General: Comply with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: For surface raceways, fittings, hinged-cover enclosures, and cabinets.

1.4 QUALITY ASSURANCE

A. Raceways and Boxes: Listed and labeled, NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NECA's Standard of Installation.

C. Comply with NFPA 70 – National Electrical Code.

1.5 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Metal Conduit and Tubing:
      a. Alflex Corp.
      b. Allied Tube and Conduit Div.
      c. American Flexible Conduit Co. (AFC).
      d. Anaconda Metal Hose.
      e. Coleman Cable Systems, Inc.
      f. Electri-Flex Co.
      g. Grinnel Co.; Allied Tube and Conduit Div.
      h. Spiraduct, Inc.
      i. Accepted Substitute in accordance with Section 01600.
   2. Nonmetallic Conduit and Tubing:
      a. Anaconda Metal Hose.
      b. Carlon Electrical Products.
      c. Certainteed Corp.
      d. Raco, Inc.
      e. Spiraduct, Inc.
      f. Thomas & Betts Corp.
      g. Accepted Substitute in accordance with Section 01600.
   3. Conduit Bodies and Fittings:
      a. Adalet-PLM.
      b. Appleton Electric Co.
      c. Carlon Electrical Products.
      d. Crouse-Hinds.
      e. Killark Electric Manufacturing Co.
      f. O-Z/Gedney.
      g. Accepted Substitute in accordance with Section 01600.
   4. Boxes, Enclosures, and Cabinets:
      a. Adalet-PLM.
      b. Carlon Electrical Products.
      c. Crouse-Hinds.
      d. Daniel Woodhead Co.
      e. Killark Electric Manufacturing Co.
      f. O-Z/Gedney.
      g. Thomas & Betts Corp.
      h. Walker.
      i. Accepted Substitute in accordance with Section 01600.

2.2 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

D. EMT and Fittings: ANSI C80.3.
   1. Fittings: Compression type.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.

B. RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

2.4 NEMA FB OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

2.5 FLOOR BOXES

A. Floor Boxes: Cast metal, fully adjustable, rectangular.

B. Floor Boxes: Nonmetallic, nonadjustable, round.

2.6 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: 1, cast aluminum with gasketed cover.

2.7 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Outdoors: Use following wiring methods:
   1. Exposed: Rigid steel.
   2. Concealed: Rigid steel.
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Indoors: Use following wiring methods:
   1. Exposed: EMT.
   2. Concealed: EMT.
   3. Connection to Vibrating Equipment (Including Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
   4. Damp or Wet Locations: Rigid steel conduit.
   5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
      a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Minimum Raceway Size: 3/4-inch trade size (DN21).

C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Install raceways level and square and at proper elevations. Provide adequate headroom.

F. Complete raceway installation before starting conductor installation.

G. Support raceways as specified in Section 16050 - Basic Electrical Materials and Methods.

H. Use temporary closures to prevent foreign matter from entering raceways.

I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above finished slab.

J. Make bends and offsets so ID is not reduced. Keep legs of bends in same plane and straight legs of offsets parallel, unless otherwise indicated.

K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

L. Run concealed raceways, with minimum of bends parallel to or by right angles to structural members considering type of building construction and obstructions, unless otherwise indicated.

M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1 inch concrete cover.
   1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   2. Space raceways laterally to prevent voids in concrete.
   3. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

N. No exposed raceways are allowed, except installed in electrical rooms.

O. Join raceways with fittings designed and approved for purpose and make joints tight.
   1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
   2. Use insulating bushings to protect conductors.

P. Tighten setscrews of threadless fittings with suitable tools.

Q. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside box.

R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box and tighten chase nipple so no threads are exposed.

S. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200 pounds tensile strength. Leave at least 12 inches of slack at each end of pull wire.

T. Telephone and Signal System Raceways, 2 Inch Trade Size (DN53) and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

U. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces or interior to exterior locations.
   2. Where otherwise required by NFPA 70.

V. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

W. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

X. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

Y. Surface Raceways: Install separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
   1. Select each surface raceway outlet box, to which lighting fixture is attached, of sufficient diameter to provide seat for fixture canopy.
   2. Where surface raceway is used to supply fluorescent lighting fixture having central-stem suspension with backplate and canopy (with or without extension ring), no separate outlet box is required.
   3. Provide surface metal raceway outlet box, and backplate and canopy, at feed-in location of each fluorescent lighting fixture having end-stem suspension.
   4. Where surface metal raceway extension is made from existing outlet box on which lighting fixture is installed, no additional surface-mounted outlet box is required. Provide backplate slightly smaller than fixture canopy.

Z. Set floor boxes level and trim after installation to fit flush to finished floor surface.

AA. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.4 PROTECTION AND CLEANING

A. Provide final protection and maintain conditions, in manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

B. Cleaning: Comply with Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

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