SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

Latest Update: 02-12-2020 See Underlined Text for Edits.

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off all "Underlines".)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 26.

SUMMARY

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.2 DEFINITIONS

A. RMC: Rigid metallic conduit.

B. PVC/RMC: PVC coated rigid metallic conduit.

C. EMT: Electrical metallic tubing.

D. ENT: Electrical nonmetallic tubing.

E. EPDM: Ethylene-propylene-diene terpolymer rubber.

F. FMC: Flexible metal conduit.

G. IMC: Intermediate metal conduit.

H. LFMC: Liquidtight flexible metal conduit.

I. LFNC: Liquidtight flexible nonmetallic conduit.

J. NBR: Acrylonitrile-butadiene rubber.

K. RNC: Rigid nonmetallic conduit.

1.3 SUBMITTALS

A. Product Data: For raceways, wire ways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets include layout drawings showing components and wiring.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Source quality-control test reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

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

1.5 WARRANTY/GUARANTEE

A. See Division 26 Specification Section “Basic Electrical Requirements’ for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. O-Z Gedney; a unit of General Signal.
7. Wheatland Tube Company.
8. <Insert manufacturer's name.>

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

F. EMT: ANSI C80.3.

G. FMC: Zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel [compression] type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. AFC Cable Systems, Inc.
2. Arnco Corporation.

3. CertainTeed Corp.; Pipe & Plastics Group.
4. Lamson & Sessions; Carlon Electrical Products.
5. Manhattan/CDT/Cole-Flex.
6. RACO; a Hubbell Company.
7. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for plenum [riser] general-use installation.

2.4 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type. Secured with stainless steel screws.

E. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by UM.
   1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
      a. Thomas & Betts Corporation.
      b. Walker Systems, Inc.; Wiremold Company (The).
      c. Wiremold Company (The); Electrical Sales Division.
   2. Surface mounted raceways at laboratory benches shall be Wiremold V3000 series or pre-approved equivalent with a gray finish as follows:
      a. Steel construction, gray, scratch resistant finish.
      b. Two piece separable base and cover plate.
      c. Complete with entrance junction boxes, wire retainer clips, device brackets, end plates, etc.
      d. Power outlets, NEMA type, at locations indicated on the CD's.
      e. Power outlets within six feet of the sink shall be GFCI type.
      f. Each receptacle shall be neatly marked on the inside cover with indelible marker identifying the panel and breaker from which it is fed and durable markers or tag inside outlet box. This to ensure the correct covers are restored after room renovations and/or painting. In addition to marking circuit identification inside the cover, also provide laminated label with circuit number on device cover plates. Provide white background label with bold black lettering.

2.6 FLOOR MOUNTED WIREWAY SYSTEMS:

A. The floor-mounted wireway system is to be utilized in dry, interior locations only as covered in Article 386 of the National Electrical Code, as adopted by the National Fire Protection Association and as approved by the American National Standards Institute. The electrical power components of the Connectrac floor-mounted wireway system for modular furniture connectivity are listed by Underwriters Laboratories under File No. E139699, Project No. 05NK22224. Connectrac systems shall not be installed in any jurisdiction where local Codes or regulations forbid its use without specific written authorization of the governing Code official.

B. The floor-mounted wireway system specified herein for branch circuit wiring and / or data, communications, video and other low-voltage wiring shall be the Connectrac floor-mounted wireway system for modular furniture connectivity as manufactured by Strong Products Group, Ltd. Systems of other manufacturers may be considered equal if, in the opinion and written approval of the specifier, they meet all of the performance standards specified herein.

C. The metal device box and flexible low-profile flexible conduit which will house the supplied power wires must be UL listed. Other system components include extruded aluminum base track, extruded aluminum snap-on cap, and MDF side ramps along the entire length of the wireway system.

D. The wireway shall be comprised of an aluminum base track and mating aluminum top cap. MDF side ramps which associate with the base track and extend the length of the system shall complete the wireway system. Power and communications wiring shall be available in 4' and 8' lengths, which shall be field-cut to the length required.

E. Other system components shall include, but not be limited to, molded plastic end transition ramps and steel junction box(es). The junction box components shall have separate chambers to accommodate power wires and low-voltage communications. Knock-out holes in the power wiring chamber which will accept standard flexible conduit fittings shall be provided. Such knockout holes shall be located at the top and side of this chamber.

F. Submit product data sheets with all components highlighted and shop drawings identifying all required components.

G. Products:

1. Refer to drawings for additional requirements.

2. 3.7 In-carpet wireway components:
    a. Wireway segments, field-cut to required length and combined as necessary. Refer to architectural floor plans for exact length.
    b. Extruded Aluminum Wireway base track and top cap.
    c. Moisture-Resistant MDF floor transition ramps.
    d. Wire Management clip.
    e. Concrete screws.
    f. Divider for power and communications wiring.

3. Wireway components and accessories, base system components:
    a. Wireway bottom track and top cap.
    b. Side transition ramps.
    c. End components.

4. Optional Accessories:
   a. Transition adapter.
   b. Grommet.
   c. Corner kits.
   d. Rough-in box.
   e. Communication box.
   f. Wall channel.
   g. Side entry kit.

5. Single Device Power:
   a. Duplex receptacle, Nema 5-20R.
   b. AV duplex.
   c. Four circuit monument.

6. Modular Power Systems:
   a. Modular duplex.
   b. Modular quad.
   c. Modular power infeed.
   d. Modular jumper cable.

7. Telecom-Single Duplex:
   a. Standard telecom kit.
   b. Audio/visual kit.
   c. Voice/data kit.

8. Telecom modular kit.

9. Final finish of all components to be determined during shop drawing review.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Hoffman.
4. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
5. O-Z/Gedney; a unit of General Signal.
6. Robroy Industries, Inc.; Enclosure Division.
7. Scott Fetzer Co.; Adalet Division.
8. Spring City Electrical Manufacturing Company.
9. Thomas & Betts Corporation.
10. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Exterior and Wet locations
   1. Cast aluminum or galvanized cast iron type.
   2. Threaded hubs.
   3. Gasket screw-on cover plates
   4. NEMA FB-1

F. Boxes embedded in concrete
   1. NEMA 4X PVC
      a. Glue-in conduit hubs
      b. Gasket cover plates
      c. Sunlight UV resistant

G. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic finished inside with radio-frequency-resistant paint.

K. Cabinets:

   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.

2.8 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.9 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: NBR <Insert sealing element> interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: PVC/RMC.
2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or 4.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Conduits > 2": Rigid Steel.
4. All wiring > than 600 volts: Rigid Steel.
5. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical and Electrical rooms and IT Rooms/Closets.
    d. <Insert designations of applicable spaces or locations.>

6. Concealed in Ceilings and Interior Walls and Partitions: EMT.
7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
8. Damp or Wet Locations: Rigid steel conduit.
9. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
10. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
11. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
12. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: Three quarter (3/4) inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

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

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

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

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to rigid steel conduit or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least twelve (12) inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. Three quarter (3/4) Inch Trade Size and Smaller: Install raceways in maximum lengths of fifty (50) feet.
2. One (1) Inch Trade Size and Larger: Install raceways in maximum lengths of seventy five (75) feet.

3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30^0F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125^0F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155^0F temperature change.
   c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125^0F temperature change.
   d. Attics: 135^0F temperature change.
   e. <Insert location and corresponding temperature change.>

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per ^{0}F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of seventy two (72) inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 FLOOR MOUNTED WIREWAY SYSTEMS:

A. Installation: The installer shall thoroughly review and comply with the detailed manufacturer's instruction sheets which accompany the system components. Installation must be coordinated with architectural floor finishes.

B. Mechanical Security: The aluminum base track, MDF side ramps and molded plastic end transition ramps shall be securely fastened to the floor slab in accordance with the manufacturer's instructions.

C. Electrical Security: Metal device boxes shall be mechanically fastened to the floor slab in accordance with the manufacturer's instructions. Flexible conduit connections shall be installed with the provided conduit end fitting in accordance with National Electric Code for proper grounding.

D. Completeness: All Connectrac systems shall be installed complete, including insulating bushings and inserts where required by the manufacturer's installation instructions. Any openings in system components shall be closed. Complete installation of the Connectrac system includes installation of floor covering over the MDF side ramp and end transition ramps.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than fifty (50) inches and no side greater than 16 inches, thickness shall be 0.052 inch.

2. For sleeve cross-section rectangle perimeter equal to, or greater than, fifty (50) inches and one (1) or more sides equal to, or greater than, sixteen (16) inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors two (2) inches above finished floor level.

H. Size pipe sleeves to provide one quarter (1/4) inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to re-

store original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.7 PROTECTION

A. Provide final protection and maintain conditions 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.

END OF SECTION 260533