SECTION 16130

RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring

B. Related Sections include the following

1. Section 02584 for exterior ductbanks, manholes, and underground utility construction

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing

B. EPDM: Ethylene-propylene-diene terpolymer rubber

C. FMC: Flexible metal conduit

D. LFMC: Liquidtight flexible metal conduit

E. NBR: Acrylonitrile-butadiene rubber

F. GRC: Galvinized rigid metallic conduit

G. RNC: Rigid nonmetallic conduit

1.4 SUBMITTALS

A. In accordance with Section 01340

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

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

1. Custom enclosures and cabinets

1.5 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

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one 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. Manhattan/CDT/Cole-Flex
7. Maverick Tube Corporation
8. O-Z Gedney; a unit of General Signal
9. Wheatland Tube Company

B. Rigid Steel Conduit: ANSI C80.1

C. Aluminum Rigid Conduit: ANSI C80.5

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

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

E. EMT: ANSI C80.3

F. FMC: Zinc-coated steel

G. LFMC: Liquid tight flexible steel conduit with PVC jacket

H. 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

I. Joint Compound for Rigid Steel Conduit: 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 of the following

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose
3. Arnco Corporation
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products
10. Manhattan/CDT/Cole-Flex
11. RACO; a Hubbell Company
12. Thomas & Betts Corporation

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

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

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 general-use installation

2.4 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one 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, NEMA type as required, 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 and flanged-and-gasketed type

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. Thomas & Betts Corporation
   b. Walker Systems, Inc.; Wiremold Company (The)
   c. Wiremold Company (The); Electrical Sales Division

2.6 BOXES, ENCLOSURES, AND CABINETS

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

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

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

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

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2

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

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover

G. 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

H. Cabinets for SCADA Sytem PLC Enclosures

1. NEMA 250, Type 4, 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

2.7 SLEEVES FOR RACEWAYS

A. Refer to Section 16120

B. Coordinate sleeve selection and application with selection and application of firestopping, where required

2.8 SLEEVE SEALS

A. Refer to Section 16120

B. Coordinate sleeve selection and application with selection and application of firestopping, where required

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

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

1. Exposed conduit: GRC - Galvinized rigid steel conduit
2. Concealed conduit, aboveground: Rigid steel conduit or EMT
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 4

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

1. Exposed, not subject to physical damage: GRC
2. Exposed, not subject to severe physical damage: GRC
3. Exposed and subject to severe physical damage: GRC
4. Concealed in ceilings and interior walls and partitions: EMT or GRC
5. Connection to vibrating equipment (including transformers and hydraulic, pneumatic, electric solenoid, or motor-driven equipment): FMC, except use LFMC in damp or wet locations

6. Damp or wet locations: GRC
7. Raceways for optical fiber or communications cable in spaces used for environmental air: Plenum-type, optical fiber/communications cable raceway or EMT
8. Raceways for optical fiber or communications cable risers in vertical shafts: Riser-type, optical fiber/communications cable raceway or EMT
9. Raceways for concealed general purpose distribution of optical fiber or communications cable: General-use, optical fiber/communications cable raceway
10. Boxes and enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations

C. Minimum Raceway Size: ¾-inch trade size

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

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

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

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

G. 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 RNC to GRC before rising above the floor
4. As detailed on the Drawings

H. 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

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

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

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

1. ¾-inch trade size: Install raceways in maximum lengths of 50 feet
2. 1-inch trade size and larger: Install raceways in maximum lengths of 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

L. 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

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, 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 deg F temperature change
   b. Outdoor locations exposed to direct sunlight: 155 deg F temperature change
   c. Indoor spaces connected with the outdoors without physical separation: 125 deg F temperature change
   d. Attics: 135 deg F 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 deg 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

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for 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

O. 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

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping, where required

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 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, 50 inches and 1 or more sides equal to, or greater than, 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 2 inches above finished floor level

H. Size pipe sleeves to provide ¼-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed

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 Section 07900 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

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

N. Underground, Exterior Wall Penetrations: Install cast iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals

3.4 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations

B. 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

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly

3.6 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