

Section 16130

Raceways and Boxes

PART 1: General

- 1.1 *Summary* – This Section includes raceways, fittings, boxes, enclosures, accessories for direct buried duct, and cabinets for electrical wiring.
- 1.2 *Definitions* –
 - 1.2.1 *EPDM* – Ethylene-propylene-diene terpolymer rubber
 - 1.2.2 *LFNC* – Liquid-tight flexible non-metallic conduit
 - 1.2.3 *NBR* – Acrylonitrile-butadiene rubber
 - 1.2.4 *RMC* – Rigid metal conduit
 - 1.2.5 *RNC* – Rigid nonmetallic conduit
- 1.3 *Submittals* –
 - 1.3.1 *Product Data* – For raceways, wire ways and fittings, hinged-cover enclosures, and cabinets.
 - 1.3.2 *Shop Drawings* – For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1.3.2.1 Custom enclosures and cabinets.
 - 1.3.2.2 For hand holes and boxes for underground wiring, including the following:
 - 1.3.2.2.1 Duct entry provisions, including locations and duct sizes
 - 1.3.2.2.2 Frame and cover design
 - 1.3.2.2.3 Grounding details
 - 1.3.2.2.4 Joint details
 - 1.3.2.2.5 Bell ends
 - 1.3.2.2.6 Bends
 - 1.3.2.2.7 Fittings
 - 1.3.2.2.8 Solvent cement

1.4 *Quality Assurance* –

1.4.1 *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.

1.4.2 *Standards* – Comply with NFPA 70.

1.5 *Delivery, Storage, and Handling* – Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

1.6 *Coordination* –

1.6.1 Coordinate layout and installation of ducts and hand holes with final arrangement of other utilities, site grading, and surface features as determined in the field.

1.6.2 Coordinate elevations of ducts entrances into hand holes with final locations and profiles of ducts as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to hand holes.

PART 2: Products

2.1 *Metal Conduit* –

2.1.1 *Manufacturers* – Subject to compliance with requirements, provide products by one of the following:

2.1.1.1 AFC Cable Systems, Inc.

2.1.1.2 Alflex Inc.

2.1.1.3 Allied Tube & Conduit; a Tyco International Ltd. Co.

2.1.1.4 Anamet Electrical, Inc.; Anaconda Metal Hose.

2.1.1.5 Electri-Flex Co.

2.1.1.6 Manhattan/CDT/Cole-Flex.

2.1.1.7 Maverick Tube Corporation.

2.1.1.8 O-Z Gedney; a unit of General Signal.

2.1.1.9 Wheatland Tube Company.

2.1.2 *Aluminum Rigid Conduit* – ANSI C80.5.

2.1.3 *IMC* – ANSI C80.6.

2.1.4 *Fittings for Conduit (Including all Types and Flexible and Liquid-Tight) and Cable* – NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

2.1.4.1 Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.

2.1.4.2 Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.100 inch, with overlapping sleeves protecting threaded joints.

2.1.5 *Joint Compound for Rigid Aluminum 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. All conduit bodies shall be Form 7.

2.2 *Nonmetallic Conduit* –

2.2.1 *Manufacturers* – Subject to compliance with requirements, provide products by one of the following:

2.2.1.1 AFC Cable Systems, Inc.

2.2.1.2 Anamet Electrical, Inc.; Anaconda Metal Hose.

2.2.1.3 Arco Corporation.

2.2.1.4 CANTEX Inc.

2.2.1.5 CertainTeed Corp.; Pipe & Plastics Group.

2.2.1.6 Condux International, Inc.

2.2.1.7 ElecSYS, Inc.

2.2.1.8 Electri-Flex Co.

2.2.1.9 Lamson & Sessions; Carlon Electrical Products.

2.2.1.10 Manhattan/CDT/Cole-Flex.

2.2.1.11 RACO; a Hubbell Company.

2.2.1.12 Thomas & Betts Corporation.

2.2.2 *RNC* – NEMA TC 2, Type EPC-80-PVC, UL 651, unless otherwise indicated.

2.2.3 *Fittings for RNC* – NEMA TC 3 and UL 514B; match to conduit or tubing type and material.

2.2.4 *LFNC* – Flexible PVC core with PCV jacket, smooth inner surface with integral reinforcement within the conduit wall.

2.3 *Custom-Built Metal Wire Ways* –

- 2.3.1 *Description* – Custom-built stainless steel framing with open ventilated stainless steel mesh sides. Mesh sides shall consist of individual framing, and bolted on with stainless steel (316L) bolts for removable access panels to cable within wire way.
- 2.3.2 *Fittings and Accessories* – Include stainless steel (316L) couplings, adapters, hold-down straps, strain relief, and other fittings to match and mate with wire ways as required for complete system.
- 2.3.3 *Wire Way Covers* – Bolt-on type, unless otherwise indicated.
- 2.3.4 *Additional Requirements* – Refer to Drawings for additional requirements.
- 2.4 *Hand Holes for Exterior Underground Wiring* –
 - 2.4.1 *Polymer-Concrete Hand Holes* – Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
 - 2.4.1.1 *Available Manufacturers* – Subject to compliance with requirements, Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2.4.1.1.1 Hubble Power Systems, Quazite
 - 2.4.1.1.2 Armorcast Products Company
 - 2.4.1.1.3 Carson Industries LLC
 - 2.4.1.1.4 CDR Systems Corporation
 - 2.4.1.2 *Basis-of-Design Product* – Subject to compliance with requirements, provide the product size indicated on Drawings.

PART 3: Execution

- 3.1 *Raceway Application* –
 - 3.1.1 *Outdoors* – Apply raceway products as specified below, unless otherwise indicated:
 - 3.1.1.1 *Above-Grade Conduit* – Rigid aluminum conduit
 - 3.1.1.2 *Underground Conduit* –
 - 3.1.1.2.1 Wet well to control panel conduit routing: Rigid aluminum conduit schedule 80 shall be used when transitioning through a concrete slab from below grade PVC conduit.
 - 3.1.1.2.2 All underground conduit shall be RNC, Type EPC-80-PVC direct buried, unless noted otherwise on the drawings.
 - 3.1.1.3 *Connection to Vibrating Equipment (Including Transformers, HVAC Units)* – LFNC.

- 3.1.1.4 *Boxes and Enclosures, Above-Ground* – NEMA 250. Boxes shall be Appleton FS Series or equal.
- 3.1.1.5 *Hand holes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles* – Polymer concrete, SCTE 77, Tier 15 structural load rating.
- 3.1.1.6 *Conduit Unilet Bodies* – Conduit unilet bodies shall be Appleton form 35 or equal.

3.1.2 *Minimum Raceway Size* – Use a 1-inch trade size.

3.1.3 *Raceway Fittings* – Compatible with raceways and suitable for use and location.

- 3.1.3.1 Rigid Aluminum Conduit: Use threaded rigid aluminum conduit fittings, unless otherwise indicated.
- 3.1.3.2 Corrosion Prevention: Aluminum conduits in contact with concrete or earth shall be wrapped with 2 wraps of anti-corrosion tape, suited for use of protecting metal from corrosion. Tape shall be half-wrapped in one direction, and then back in the opposite direction for a total of 2 half wraps.

3.2 *Installation* –

3.2.1 *Standards* – 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.

3.2.2 *General* –

- 3.2.2.1 Complete raceway installation before starting conductor installation.
- 3.2.2.2 Support raceways as specified in Section 16073-"Hangers and Supports for Electrical Systems."
- 3.2.2.3 Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- 3.2.2.4 Install no more than the equivalent of three 90-degree bends in any conduit run.
- 3.2.2.5 Contractor shall allow for 5 conduits (minimum) per pump from control panel or J-box to wet well. Contractor shall allow for 5 conduits 1 inch (minimum) to Instrument/float hatch from control panel or J-Box.

3.2.3 *Raceways Embedded in Slabs* – 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.

3.2.4 *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.

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

3.2.6 *Flexible Conduit Connections* – Use maximum of 36 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers.

3.2.6.1 Use LFNC in damp or wet locations.

3.3 *Installation of Underground Conduit* –

3.3.1 *Direct-Buried Conduit* –

3.3.1.1 Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 2100-"Earthwork" for pipe less than 6 inches in nominal diameter.

3.3.1.2 Install backfill as specified in Section 2100-"Earthwork."

3.3.1.3 After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.

3.3.1.4 Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

3.3.1.5 Install manufactured duct elbows for stub-ups at poles and equipment, unless otherwise indicated.

3.3.1.6 Install manufactured rigid aluminum conduit elbows for stub-ups at poles and equipment. Couple aluminum conduits to ducts with adapters designed for this purpose.

3.3.1.7 Bury warning tape approximately 12 inches above direct-buried conduits.

3.3.2 *Slope* – Pitch ducts a minimum slope of 1:300 down toward hand holes or wet well and away from equipment. Slope ducts from a high point in runs between two hand holes to drain in both directions.

3.3.3 *Curves and Bends* – Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.

3.3.4 *Duct Entrances to Polymer Concrete Hand Holes* – Use end bells, spaced approximately 10 inches on center for 5-inch ducts, and vary proportionately for other duct sizes.

3.3.4.1 Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.

3.3.4.2 Grout end bells into structure walls from both sides to provide watertight entrances.

- 3.3.5 *Clean Prior to Pulling Conductors or Cables* – Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- 3.4 *Installation of Underground Hand holes* –
 - 3.4.1 Install hand holes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
 - 3.4.2 Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
 - 3.4.3 Field-cut openings for conduits according to enclosure Manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- 3.5 *Grounding* – Ground underground ducts and utility structures according and NFPA 70.
- 3.6 *Protection* – Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 3.6.1 Repair damage to stainless steel finishes in accordance with Manufacturer recommendations.
 - 3.6.2 Repair damage to PVC finishes with matching touchup coating recommended by Manufacturer.