PART 1 - GENERAL

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

1.2 SUBMITTALS
   A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
   B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 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. Rigid Steel Conduit: ANSI C80.1.
   B. IMC: ANSI C80.6.
   C. EMT: ANSI C80.3.
   D. FMC: Zinc-coated steel (Aluminum is not permitted)
   E. LFMC: Flexible steel conduit with PVC jacket.
   F. 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.
      2. Fittings for EMT: Steel or die-cast, compression type.
2.2 NONMETALLIC CONDUIT AND TUBING


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

C. LFNC: UL 1660.

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

E. Fittings for LFNC: UL 514B.

2.3 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, Type 1 12 3R, 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: Flanged-and-gasketed type, or as indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hoffman.
   2. Lamson & Sessions; Carlon Electrical Products.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

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.
2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Engineer.

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

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Engineer from manufacturer's standard colors.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell Incorporated; Wiring Device-Kellems Division.
   b. Panduit Corp.

2.6 BOXES, ENCLOSURES, AND CABINETS

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

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

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

D. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.

E. Nonmetallic Floor Boxes: Nonadjustable, round.

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

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

H. Hinged-Cover Enclosures: NEMA 250, Type 1, or as specified on engineering design drawings, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

I. 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.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholds and Boxes:

1. Boxes and handholds for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete handholds and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with Open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhold location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC".
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

C. Fiberglass handholds and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhold location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC".

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit (Surface Mounted or concealed behind panels designed to allow access): Rigid steel conduit or IMC.
2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC, EMT, or RNC Type EPC-40-PVC.
3. Underground Conduit: RNC, Type EPC-40 or 80-PVC, direct buried.(or as specified)
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC or LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or as specified.

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

1. Exposed, Not Subject to Physical Damage: EMT, ENT or RNC.
2. Exposed, Not Subject to Severe Physical Damage: EMT or RNC identified for such use.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit, IMC. Includes raceways in the following locations:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT, ENT, or RNC, Type EPC-40-PVC.
5. With written permission of the SRP Engineer. FMC may be used in existing walls. FMC must be transitioned to EMT, ENT, or RNC as soon as possible after the FMC exits the wall.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, and use LFMC in damp or wet locations.
7. Damp or Wet Locations: Rigid steel conduit, IMC.
8. Raceways for Optical Fiber or Communications Cable: EMT or ENT.
9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel or nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings:

1. Rigid Steel and IMC: Use threaded rigid steel conduit fittings or compression couplings, unless otherwise indicated. Screw couplings are not permitted.

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. Support raceways as specified in Division 26 Section "Hangers and Supports."

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 under Slabs:
   1. Run conduit a minimum of 24 inches below finished grade or as specified on engineering drawings.
   2. Change from RNC, Type EPC-40-PVC, to rigid steel conduit, or IMC before rising above the floor.

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 as follows:
   1. 3/4-Inch Trade Size and Smaller: 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 above ground 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 recessed and semi-recessed 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.

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.

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

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

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31" Site Work" for pipe less than 6 inches in nominal diameter.
   2. Install backfill as specified in Division 31 " Site Work."
   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 as specified in Division 31 "Site Work."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   
a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   
b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
   
5. Warning Tape: Bury warning tape approximately 12 inches above direct-buried conduits.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

END OF SECTION