SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

1.2 REFERENCES

A. ANSI C80.1 - Electrical Rigid Steel Conduit, Zinc Coated.
B. ANSI C80.3 - Steel Electrical Metallic Tubing, Zinc Coated.
C. ANSI C80.5 - Electrical Rigid Aluminum Conduit.
D. NECA (National Electrical Contractor’s Association) - "Standard of Installation"
E. NEMA FB 1 (National Electrical Manufacturers Association) - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
F. NEMA OS 1 (National Electrical Manufacturers Association) - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
G. NEMA OS 2 (National Electrical Manufacturers Association) - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
H. NEMA RN 1 (National Electrical Manufacturers Association) – Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
I. NEMA TC 2 (National Electrical Manufacturers Association) - Electrical Polyvinyl Chloride (PVC) Conduit.
J. NEMA TC 3 (National Electrical Manufacturers Association) - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
K. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures
B. Product Data: Submit for the following products:
   1. Flexible metal conduit.
2. Liquidtight flexible metal conduit.
3. Nonmetallic conduit.
4. Flexible nonmetallic conduit.
5. Raceway fittings.
6. Conduit bodies.
7. Surface raceway.
8. Wireway.
9. Pull and junction boxes.

1.4 CLOSEOUT SUBMITTALS
A. Section 01 77 00 - Execution Requirements: Closeout procedures.
B. Project Record Documents:
   1. Record actual routing of conduits larger than 2-inch trade size.

1.1 QUALIFICATIONS
1.5 DELIVERY, STORAGE, AND HANDLING
A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
B. Protect PVC conduit from sunlight.

1.6 COORDINATION
A. Section 01330 - Administrative Requirements: Coordination and project conditions.
B. Coordinate installation of outlet boxes for equipment.
C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

1.7 SYSTEM DESCRIPTION
A. Raceway and boxes located as shown on drawings, and at other locations where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway as required to complete wiring system. Refer to conductors and cables specification section for application of type MC cable.
B. Each length of conduit shall bear the UL label.
C. Underground, More than 5 feet outside Foundation Wall: Use rigid steel conduit or schedule 40 nonmetallic conduit. Use cast metal boxes or nonmetallic handhole.
D. Underground, Within 5 feet from Foundation Wall: Use rigid steel conduit. Use cast metal or nonmetallic boxes.
E. In or Under Slab on Grade: Use rigid steel conduit, or schedule 80 nonmetallic conduit. All conduits in slab must be approved by structural engineer. Use cast or nonmetallic metal boxes.

F. Outdoor Locations, Above Grade: Use rigid steel conduit, electrical metallic tubing or schedule 40 nonmetallic conduit. Use cast metal or nonmetallic outlet, pull, and junction boxes.

G. In Slab Above Grade: Use rigid steel conduit, or schedule 80 nonmetallic conduit. All conduits in slab must be approved by structural engineer. Use cast or nonmetallic boxes.

H. Wet and Damp Locations: Use rigid steel conduit, electrical metallic tubing, flexible liquid type or schedule 40 nonmetallic conduit. Use cast metal or nonmetallic outlet, junction, and pull boxes. In damp locations, sheet metal boxes are permitted. Use flush mounting outlet box in finished areas.

I. Concealed Dry Locations: Use rigid steel conduit, electrical metallic tubing, flexible metallic tubing, type MC cable or schedule 40 nonmetallic conduit. Use sheet-metal outlet, junction and pull boxes. Use flush mounting outlet box in finished areas. Use hinged enclosure for large pullboxes.

J. Exposed Dry Locations: Use rigid steel conduit, electrical metallic tubing, flexible metallic tubing, or schedule 40 nonmetallic conduit. Use sheet-metal outlet, junction and pull boxes. Use flush mounting outlet box in finished areas. Use screw cover or hinged enclosure for large pullboxes.

K. Plastic Conduit (PVC):
   1. Use Schedule 40 PVC, approved for use as non-metallic raceway for 90 degree C conductors for underground conduits. Do not use type DB or Schedule 20. Use wrapped, rigid steel conduit for exposed risers. PVC risers with end bells may be used with in Christy boxes, switchgear and transformer enclosures. Underground conduits >600 volts shall be encased in red concrete, 3” all around. Surround conduits for <600 volts with 3” of smooth sand all around.

L. Minimum Raceway Size: 1/2 inch unless otherwise noted. Use ¾ inch minimum for home runs and areas where future expansion is likely.

M. Maximum conductor fill: Conduit fill for branch circuits (not feeders) shall be limited to the maximum for the next smaller size conduit to allow for future additions. Exceptions: Short runs to a single outlet in existing work (remodel) may be ½ inch. Extensions and connections to single fixtures may be ½ inch.

**PART 2 - PRODUCTS**

2.1 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1. Finished inside and out by hot dip galvanizing.
B. Rigid Aluminum Conduit: ANSI C80.5.

C. Intermediate Metal Conduit (IMC): Light weight rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit, all steel fittings to be electroplated.
   1. Insulated bushings: Threaded polypropylene or thermo setting phenolic steel body with insulated throat and ‘layin’.
   2. Insulated grounding bushings: Lug with compression screw.
   3. Insulated metallic bushing: Steel body with plastic insulated throat.

2.2 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction fabricated in continuous lengths from galvanized steel strip, spirally wound.

B. Fittings: NEMA FB 1. Screw clamp or screw in variety with cast malleable iron bodies and threaded male hubs with insulated throats or insulated bushings.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC jacket.


2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing, cold rolled strip steel.

B. Fittings and Conduit Bodies: NEMA FB 1; steel (not cast), compression or set screw type.

2.5 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 PVC (thickwall), 80 PVC (heavywall).

B. Fittings and Conduit Bodies: NEMA TC 3.

2.6 SURFACE METAL RACEWAY

A. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

B. Finish: Manufacturer’s standard gray.

C. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.
2.7 SURFACE NONMETAL RACEWAY

A. Product Description: Plastic or fiberglass channel with fitted cover, suitable for use as surface raceway.

B. Finish: White, Ivory or Grey as directed.

C. Fittings, Boxes, and Extension Rings: Furnish manufacturers standard accessories, finish to match raceway.

2.8 WIREWAY

A. PROJECT SPECIFIC ITEM

1. Product Description: [General purpose], [Oiltight and Dust-tight], [Rain tight] type wireway]. AS REQUIRED BY THE APPLICATION

2. Knockouts: Manufacturer's standard.

3. Cover: Hinged cover with full gasketing if outdoor. Screw cover, if indoor.


5. Fittings: Lay-in type with drip shield, if outdoor.

6. Finish: Rust inhibiting primer coating with gray enamel finish.

2.9 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized. One piece, drawn steel. Minimum size: 4 inch square by 1 ½ inch deep. Knock-out type of size and configuration best suited to the application indicated on the plans.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported.

2. Concrete Ceiling Boxes: Concrete type.

B. Switch Boxes: Use minimum 4-square with mud ring or raised cover, use of single gang two (2) inches wide by three (3) inches long, 1-1/2 inches deep, galvanized steel switch boxes shall be used only for the installation of single switches where 4-square boxes will not fit. Multiple switches shall be installed in standard gang boxes with raised device covers suitable for the application indicated.

C. Nonmetallic Outlet Boxes: NEMA OS 2.

D. Cast Boxes: NEMA FB 1, Type FD, cast ferroalloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

E. Wall Plates for Finished Areas: As specified in wiring devices specification section.

2.10 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized one piece, drawn steel, 4 inch square by 1 ½ inch deep where possible, otherwise 16 gauge galvanized sheet metal, NEMA 1, sized to code.
B. Hinged Enclosures: As specified in cabinets and enclosures specification section.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4, 4X or 6; flat-flanged, surface mounted junction box:
   1. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, inside flanged, recessed cover box for flush mounting:
   1. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
   2. Cover Legend: "ELECTRIC", “LIGHTING”, OR “TELEPHONE” as appropriate for contents.

E. In ground cast concrete box: (Christy)
   1. Cover: Nonskid cover.
   2. Cover Legend: "ELECTRIC", “LIGHTING”, OR “TELEPHONE” as appropriate for contents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 33 00 - Administrative Requirements: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Install raceway and boxes in accordance with NECA "Standard of Installation."

B. Wherever possible, conduits shall be concealed in walls or furred ceilings and in poured-in-place concrete slabs. Concealed conduits shall be run in as direct a route as possible and with bends of code-required minimum large radii. Floor penetrations shall be made only at specific approved locations; other penetrations are prohibited. In furred ceiling areas, conduits shall be run above carrying bars. Conduits shall be rigidly secured in position by means of approved clamps.

C. Locations of conduit runs shall be planned in advance of the installation and coordinated with the ductwork, plumbing, ceiling, and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

D. All exposed conduits shall be installed straight and true with reference to the adjacent work.
E. Exposed vertical conduit runs shall be supported at each floor level, independent of cabinets or switches to which they run, by means of approved supports.

F. For rigid steel conduit, running threads and threadless couplings will not be acceptable. Where necessary for connecting conduit, UL listed couplings or unions shall be used.

G. Ground and bond raceway and boxes as specified elsewhere in Electrical specifications.

H. Arrange raceway and boxes to maintain headroom and present neat appearance.

I. Supports:
   1. All raceway systems shall be secured to building structures using specified fasteners, clamps, and hangers spaced according to code requirements.
   2. Single runs of conduit shall may be supported using one hole pipe straps. Where run horizontally on walls in damp or wet locations, "clamp backs" shall be installed to space conduit off the surface.

3.3 INSTALLATION--RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route as required to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel as specified elsewhere in Electrical specifications.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.

F. Do not attach raceway to ceiling support wires or other piping systems, except for fixture whips or manufactured wiring systems as allowed by CEC 300.

G. Route exposed raceway parallel and perpendicular to walls.

H. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

I. Route conduit in and under slab from point-to-point.

J. Maximum Size Conduit in Slab Above Grade: ¾ inch. Coordinate with the Structural Engineer. Avoid crossing conduits in slab unless approved by structural engineer.

K. Maintain adequate clearance between raceway and piping.

L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
M. Cut conduit square using saw or pipecutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely. In long runs of conduit, pull boxes shall be provided with support structures independent of conduit supports and with spacing not to exceed 100 feet.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting.

P. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Use conduit bodies to make sharp changes in direction, such as around beams.

R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

S. Provide suitable fittings to accommodate expansion and deflection where raceway crosses seismic expansion joints.

T. Provide suitable pull string or cord in each empty raceway except sleeves and nipples.

U. Use suitable caps to protect installed conduit against entrance of dirt.

V. Surface Raceway: Use flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

W. Close ends and unused openings in wireway.

X. In office areas install panel homerun conductors in conduits described above. Individual branch circuits may be installed with type MC cable from the junction box fed by the homerun conduit where such MC cable is concealed in walls and above ceilings and serves one device box.

3.4 INSTALLATION-BOXES

A. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

B. Adjust box location up to 10 feet prior to rough in if required to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices as specified in wiring devices specification section.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounted box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches horizontal separation in acoustic or fire rated walls.

H. Secure flush mounted box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Use stamped steel bridges to fasten flush mounted outlet box between studs.

J. Install flush mounted box without damaging wall insulation or reducing its effectiveness.

K. Use adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Use gang box where more than one device is mounted together. Do not use sectional box.

O. Use 4 inch square by 1 ½ inch deep two gang box with plaster ring for single device outlets.

P. Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs, or shall be mounted on heavy gauge galvanized steel, snap-in box supports.

Q. Fixture outlet boxes installed in suspended ceilings of gypsum board or lath and plaster construction shall be mounted to sixteen (16) gauge metal channel bars attached to main ceiling runners.

R. Fixture outlet boxes installed in suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structure above wherever pendent-mounted lighting fixtures are installed on the box.

S. Outlet boxes mounted suspended acoustical tile ceilings having concealed suspension systems may be supported from main ceiling runners. Boxes mounted above suspended ceilings having exposed suspension systems shall be supported directly from the structure above, independent of the ceiling suspension system.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack or pitch pocket. Coordinate location with roofing installation.
C. Locate outlet boxes to allow luminaires to be positioned as shown on reflected ceiling plan.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. Section 01 77 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Section 01 77 00 - Execution Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

3.8 EXISTING WORK

A. Remove exposed abandoned raceway, [including abandoned raceway above accessible ceiling finishes]. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if raceway servicing them is abandoned and removed. Provide blank cover for abandoned boxes which are not removed.

D. Ensure access to existing boxes and other installations which remain active. Modify installation or provide access panel as appropriate.

E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installation, or as specified.

END OF SECTION