SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. Specify Underwriters Laboratories (UL) or other recognized testing agency listed equipment, assemblies and materials.

B. Where appropriate, refer to current ANSI and NEMA Standards for material ratings.

C. National Electrical Code (NEC) (current edition).

D. Local Authority Having Jurisdiction

1.02 SUBMITTALS

A. Operation and Maintenance Manuals: Provide at a minimum general description and technical data.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rigid Metal Conduit: galvanized steel with steel threaded fittings.

B. Electrical Metallic Tubing: all steel set screw fittings for interior locations.

C. Flexible Metal Conduit: galvanized steel with all steel fittings. Compression-type fittings (squeeze types).

D. Liquid Tight Flexible Metal Conduit:

1. Galvanized steel with plastic jacket.
2. Specify fittings which provide grounding continuity.

E. Non-Metallic Conduit and Fittings:

1. PVC plastic Schedule 40 and Schedule 80.
2. Impregnated fiber duct (underground).
3. High Density Polyethylene Conduit, Type HDPE, Schedule 40.

F. Prohibited Materials:

1. Use of aluminum conduit is specifically prohibited unless special written permission is given by DPS Construction Services Engineer.
2. Use of extra-flexible, non-labeled conduit is prohibited
3. ENT (electrical non-metallic tubing) is prohibited
4. IMC (intermediate metal conduit) is prohibited

G. Cable Trays: Galvanized steel or aluminum, ladder type, electrically-continuous

H. Surface Wireways:

1. Steel with factory-applied paint finish or natural brushed or stainless steel finish. Coordinate finish selection with Architect prior to bid.
2. Provide two channels, one for power and one for data wiring, minimum size Wiremold 4000 or equivalent.
3. Minimum size for single channel raceway shall be Wiremold 700 or equivalent.

E. Hinged Cover Enclosures:

1. NEMA rated enclosure, steel, suitable for environment in which installed, with manufacturer's standard enamel finish.
2. Continuous hinged cover. Provide flush key lock latch (National #C413A) for enclosures in publicly accessible locations.
3. Appropriate (minimum 14 gauge) steel enclosures suitable for mounting electrical components, terminal blocks, etc.
4. Cabinets over 12" in any one dimension shall also have quarter-turn latches.

F. Cabinets:
1. Cabinet boxes:
   a) Galvanized steel with removable end walls.
   b) For television, telephone and other communication cabinets, specify with ¾" thick plywood backboard painted matte white.
   c) Require protective pocket inside front cover with schematic diagram, connection diagram and layout drawing of control wiring and components within enclosure.
2. Cabinet covers: Steel with manufacturer's standard enamel finish, concealed hinges. Provide flush key lock latch (National #C413A) for enclosures in publically accessible locations.

G. Terminal Blocks and Accessories:
1. Unit construction type, rated 600V with tubular pressure screw connectors for power terminals.
2. Modular construction type, rated 300V with tubular pressure screw connection terminals for control terminals.
3. UL-listed for application and load carried.

H. Sheet Metal Outlet Boxes: Galvanized steel, 4" square minimum with a 2-1/8" box depth minimum. Provide single or double plaster ring as required.

I. Cast Boxes: Cast ferroalloy, deep type with gasketed cover, threaded hubs.

J. Floor Boxes For Cast-In-Place Concrete Floors:
1. Prohibited without written approval from DPS.
2. Fully adjustable, cast iron or formed galvanized steel.
3. Box specifics shall be coordinated with project requirements.
4. Kitchens and Shops: Front face shall be perpendicular to the floor to prevent entrance of liquids and debris.
5. Classrooms, Media Centers, Confernce and Meeting Rooms: Face shall be flush with floor with cover rated for mop & cleaning.
6. Floor boxes for installation in concrete on grade shall be cast iron or coated steel rated for concrete on grade use.

K. Sheet Metal Boxes:
1. Galvanized steel.
2. Sheet metal boxes less than 12" in any one dimension shall comply with Hinged Cover Enclosures, this section.
3. Sheet metal boxes over 12" in any one dimension shall comply with requirements of Section Cabinets, this section.

L. Boxes For Outdoor and Wet Locations: flat flanged, surface mounted, UL-listed as raintight, galvanized cast iron box and cover with neoprene gasket and stainless steel cover screws. Code – Weatherproof when in use. Except roof tops for qualified personel.

M. Boxes For Buried Flush Grade Locations: Flat flanged, UL-listed, bottomless, galvanized cast iron, aluminum, PVC, or composite concrete box and cover with neoprene gaskets and stainless steel cover screws. Cover shall be rated for installed location, with traffic rated covers for areas where vehicle drive over may occur. Coordinate with civil to provide adequate drainage below box.

2.02 FABRICATION

A. Assemble enclosures and cabinets housing terminal blocks or electrical components at a panel shop. Panel shop shall provide UL label for enclosures and cabinets, as appropriate.

2.03 BOX EXTENSIONS

A. Prohibited in new construction and additions. Spark rings and mud rings are allowed to ensure box meets code and front of box / ring is flush with finished wall material.

B. One extension is permitted on remodel work to extend existing installations. Where more than one box is needed to flush out installation, provide a large (i.e. 6" x 6" minimum) box to flush out the existing box and nipple over to a new box.

2.04 IDENTIFICATION AND TAGGING

A. Comply with requirements of Section 26 05 53 – Identification for Electrical Systems.

B. Provide nameplates for each electrical component inside cabinet or enclosure per Section 26 05 53 – Identification for Electrical Systems. Locate nameplate next to component inside enclosure or on inside of cover.

C. All junction boxes shall have labeling on the front facing cover to indicate circuits contained within. Labels shall be clearly legible or adheasive type.

PART 3 EXECUTION

3.01 INSTALLATION AND APPLICATION

A. Exterior Conduit Installation:

1. Underground raceways (ducts) general requirements:

a) Cross ducts below gas piping.

b) Slope ducts to manholes.

c) Locate ducts below frost line or at 36" below finish grade, whichever is deeper.

d) Route ducts as straight as possible between points.

e) Specify reinforcing rods in concrete encasement for all duct banks. Specify a rebar 4-bar cage.

f) Specify approved nylon conduit spacers for multiple conduit runs in the same trench (ductbanks).

g) Require that each raceway be proved clean, clear and useable, with a #12 copper pull wire left in place. Specify duct plugs for finished raceways.

h) Specify that backfill material be clean and free of stones.

i) Concrete blocks are prohibited as duct spacers.

j) Specify nylon tie downs to hold ducts to spacers. Wire duct tie downs are prohibited.

k) Where duct banks enter buildings, manholes, etc., require a minimum of four (4) #2 rebar dowels to prevent shearing of ducts.

l) Provide minimum one spare conduit in each duct.

m) Install a solid color coded, utility specific magnetically detectable Plastic Underground Warning Tape, 6" wide by 4 mils thick, with the caption "Caution – (Utility Name) Line Buried Below", at a depth of 12" below grade when backfilling over all utilities.

n) Schedule 40 PVC or fiber-reinforced epoxy.

o) Transition duct to PVC-coated rigid metal conduit 5' from building outside wall.

2. Underground primary raceways (ducts):

a) Comply with general requirements above.

b) Electrical non-metallic conduit encased in concrete.

c) Standard conduit size 4" in all ducts.

d) Provide red color additive to concrete for identification (entire duct bank shall be red).

e) Pull mandrel through all primary ducts to verify duct integrity.

3. Underground secondary raceways: Comply with general requirements above.

a) Utilize PVC or HPDE schedule 40 for conduits that do not pass below high traffic drives or paved areas.

b) Utilize PVC schedule 80 for conduits that pass below high traffic drives or paved areas.

c) PVC non-metallic conduit fittings must be installed with solvent-applied couplings.

4. Underground communication raceways:

a) Comply with general requirements above.

b) Telephone, fiber optic, and cable TV raceway shall also comply with270533 Electrical Technology – Conduit and Boxes.

5. Small underground raceways:

a) Comply with general requirements above.

b) Utilize PVC or HPDE schedule 40 for conduits that do not pass below high traffic drives or paved areas.

c) Utilize PVC schedule 80 for conduits that pass below high traffic drives or paved areas.

d) PVC non-metallic conduit fittings must be installed with solvent-applied couplings.

e) Conduit shall be minimum 24" below finish grade.

6. Aboveground raceways:

a) PVC conduit is prohibited aboveground.

b) Route conduits as straight as possible between points.

c) Require that each raceway be proved clean, clear and useable, with a #12 copper pull wire left in place. Specify duct plugs for finished raceways.

7. Rooftop Raceways

a) Rooftop raceways will be kept to a minimum.

b) Route raceways up through curbs as much as possible to prevent unnecessary rooftop penetrations when wiring rooftop units.

c) Raceways that are required on rooftops will be cleared first by the DPS or DPS Electrical QAQC.

d) Adjustment factors that fall under NEC Article 310 Conductors for General Wiring Circular Raceways Exposed to Sunlight on Rooftops will be followed.

e) . Rooftop conduits shall be fastened to sheet metal triangle stands. Stands shall be mechanically fastened to 2'x2'x2" concrete pavers. Pavers shall be set on modified rolled roofing pads. One stand for every ten foot (10') of conduit and no more than one paver per stand. Supports shall not penetrate the roof membrane.

f) Rooftop conduits shall be fastened to sheet metal triangle stands. Stands shall be mechanically fastened to 2'x2'x2" concrete pavers. Pavers shall be set on modified rolled roofing pads. One stand for every ten foot (10') of conduit and no more than one paver per stand. Supports shall not penetrate the roof membrane .

B. Cable Tray Installation:

1. Require cable trays to be supported by threaded rod hangers. Where lateral stresses are likely to be present, require lateral threaded rod braces.
2. Specify cable tray supports a minimum of 8' on center and at all intersections and angles, unless specified otherwise by manufacturer.
3. Ground all cable tray components and fittings.

C. Surface Raceways: Require electrical continuity of all raceway components throughout length of system. Metal raceway or conduit is not to be used as a grounding path.

1. Route surface raceways tight to corners of walls and ceilings where possible to minimize visual impact.
2. Route in straight lines, parallel to architectural features.
3. For existing remodel work, avoid using in locations below 8 feet from finished floor where possible.

D. Provide recessed boxes in all finished areas.

E. Anchor securely to wall and structural supports at each corner minimum.

F. Provide nameplate per Section 260553 – Identification for Electrical Systems on ceiling grid for cabinets or other enclosures located above lay-in ceilings. Locate nameplate on ceiling grid bracing, not on ceiling tile. Nameplate shall state description of cabinet or enclosure and load served, if applicable.

G. Terminal Boxes and Panel Wiring:

1. Wires shall be of sufficient length and shall be neatly trained to the terminal point without stress.
2. Install crimp-type space connectors on screw terminals. Use pigtail connectors when the quantity of conductors exceeds the capacity of the screw terminal.
3. Make terminal connections so that there is no bare conductor at the terminal. The conductor insulation shall bear against the terminal or connector shoulder.
4. Do not obstruct equipment faceplates, controls or indicators with wire.
5. Route wire away from heat producing components such as resistors, regulators or similar equipment.

H. Provide knockout closures for all unused openings.

I. Box Locations:

1. Require electrical boxes to accommodate wire pulling, splices, taps, equipment connections and code compliance.
2. Coordinate access doors as required to provide access to boxes in hard ceilings and similar inaccessible areas.
3. Provide cast box (with threaded hubs) in high traffic areas (surface installations), as specified by owner.

J. Outlet Box Installations:

1. Back-to-back outlet boxes are not permitted. Separate boxes a minimum of 6" in standard walls and a minimum of two (2) feet in acoustical or fire-rated walls.

2. Blank cover plates be provided on all unused boxes.
3. For multiple device installations, provide multi-gang boxes. Sectional boxes are not permitted. Require barrier separation of different voltage conductors in the same box.
4. Thoroughly coordinate casework and backsplash heights with mounting heights of boxes.
5. Provide recessed outlet boxes in finished areas, supported from interior partition studs. Supports are to be stamped steel stud bridges for hollow stud walls, and adjustable steel channel fasteners for flush ceiling outlet boxes.
6. Locate boxes in masonry walls to require cutting of masonry unit edge only.

K. Pull and Junction Box Installations:

1. Wherever possible, locate pull and junction boxes above accessible ceilings in finished areas.
2. Pull or junction boxes shall be supported independently of conduit.
3. In flush grade outdoor applications, unit shall be adequately supported against settling or tipping. Where heavy traffic or poor soil compaction exists, cast box in a concrete base which provides 6" of cover around the box.

END OF SECTION 26 05 33