SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 - **GENERAL**

1.1 DESCRIPTION

A. Provide raceways and boxes in accordance with the Contract Documents.

1.2 SUBMITTALS

A. Conduit, Boxes, Wireways and Auxiliary Gutters:
   1. No requirements.

B. 2-Hour Fire Rated Cable Assemblies:
   1. Manufacturer's product data sheets.
   2. Minimum 1/8-inch scale plans showing cable assemblies on all floors.

1.3 IDENTIFICATION

A. Mark junction box covers with permanent stencil identification of panelboard and circuit numbers of wiring contained within.

PART 2 - **PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

A. Conduit and Boxes:
   1. UL Listed and labeled products of any manufacturer meeting the specified performance requirements are acceptable.

B. Modular Wiring System:
   1. Reloc, Dual-Lite, or equal.

C. Wireways and Auxiliary Gutters:
   1. Square D, or equal.
   2. Wireways and auxiliary gutters shall be UL Listed and labeled.

2.2 CONDUIT AND FITTINGS

A. Rigid Steel Conduit:
   1. Rigid conduit, heavy wall, hot-dipped galvanized inside and out, threaded ends.
   2. Threaded type fittings.

B. Electrical Metallic Tubing:
   1. Continuous, seamless steel tubing galvanized or sherardized on exterior, coated on interior with smooth hard finish of lacquer, varnish or enamel.
   2. Steel, set screw or compression type fittings. Provide concrete type fittings where required.

C. Metal Clad Cable:
   1. Light steel or aluminum armor, copper conductors, insulated copper equipment grounding conductor, and internal marker tape.
   2. Snap-in grounding type insulated throat type fitting.

D. Flexible Steel Conduit:
   1. Single strip, continuous, flexible interlocked double-wrapped steel, hot-dip galvanized inside and out forming smooth internal wiring channel.
   2. Steel, compression type fittings.

E. Liquid Tight Flexible Conduit:
   1. Same as flexible steel conduit except with tough, inert, watertight plastic outer jacket.
   2. Fittings shall be cast malleable iron body and gland nut, cadmium-plated with one-piece brass grounding bushings threaded to interior of conduit. Spiral molded vinyl sealing ring between gland nut and bushing and nylon-insulated throat.

F. Rigid Non-Metallic Conduit:
   1. Schedule 40 polyvinyl chloride suitable for 90 degrees C.
   2. Solvent cemented type fittings.

2.3 2-HOUR RATED CABLE ASSEMBLIES

A. Mineral Insulated Cable
   1. Factory assembly of one or more conductors insulated with highly compacted magnesium oxide insulation, enclosed in a seamless, liquid- and gas-tight continuous copper sheath.
   2. Conductors shall be solid, high electrical conductivity copper (suitable for equipment grounding purposes) with a cross sectional area corresponding to standard sizes.
   3. Insulation shall allow for proper spacing of conductors. Thickness on insulation shall be at least 55 mils for cable from 14 AWG through 250 MCM.
   4. Mineral-insulated cable shall be classified by Underwriters Laboratories as having a two-hour fire resistive rating.
   5. Fittings shall be identified for such use.
   6. Acceptable Manufacturer: Pyrotenax. No known equal. Cable sizes indicated are based on Pyrotenax.

B. 2-Hour Fire Rated MC Cable

C. Conduit (as covered by other parts of this section) Enclosed by 2-Hour Sheetrock

D. Conduit Encased by Concrete: minimum 2 inches of concrete.

2.4 WIREWAYS AND AUXILIARY GUTTERS

A. Sizes and shapes as indicated and/or as required.

B. Provide necessary elbows, tees, connectors, adapters, etc.

C. Continuous removable cover secured with screws and keyhole slots. Hinged cover where installed above suspended ceiling.

D. Provide wire retainers at not greater than 12 inches on center.

2.5 OUTLET, JUNCTION, AND PULL BOXES

A. Cast Type Boxes:
   1. Ferrous alloy box with inside threaded hubs for rigid steel conduit.
   2. Aluminum box with threaded hubs for rigid aluminum conduit.
   3. Ferrous alloy box with compression or inside threaded hubs with adapter for electrical metallic tubing.
   4. Cast raised cover, size matched to contour of box.
   5. Tapered threads for hubs.

B. Galvanized Pressed Steel Type Boxes:
   1. General:
      a. Pressed steel, galvanized or cadmium-plated, 4 inches minimum octagonal or square with galvanized cover or extension ring as required.
   2. Concrete Box:
      a. 4 inches minimum octagonal with removable backplate. Depth of box shall allow for minimum of 1 inch of concrete to be poured around the backplate.

3. Lighting Fixture Box:
    a. 4 inches minimum octagon.
    b. Where fixtures are mounted on or in an accessible type ceiling and a modular wiring system is not used, provide a junction box and extend flexible steel conduit to each fixture.
    c. In conditions where 4-inch octagonal box exceeds smallest dimension of fixture, provide 2-inch by 4-inch lighting fixture box in lieu of 4-inch octagonal box. At all other locations, provide standard 4-inch octagonal box. Coordinate fixture dimensions with final lighting fixture selections.
4. Provide 3/8-inch no-bolt fixture studs where required.

C. Sheet Steel Boxes:
1. No. 12 gauge sheet steel for boxes with maximum side less than 40 inches, and maximum area not exceeding 1,000 square inches; riveted or welded ¾-inch flanges at exterior corners.
2. No. 10 gauge sheet steel for boxes with maximum side 40 to 60 inches, and maximum area 1,000 to 1,500 square inches; riveted or welded ¾-inch flanges at exterior corners.
3. No. 10 gauge sheet steel riveted or welded to 1.5 inch by 1.5 inch by ¼-inch welded angle iron framework for boxes with maximum side exceeding 60 inches and more than 1,500 square inches in area.
4. Covers:
    a. Same gauge steel as box.
    b. Subdivided single covers so no section of cover exceeds 50 pounds.
    c. Machine bolts or machine screws threaded into tapped holes.
5. Paint:
    a. Rust inhibiting primer, ANSI 61 grey enamel finish coat.

2.6 ELECTRICAL BOX PADS

A. Non-Fire Rated: equal to Lowry's Outlet Box Pads as manufactured by Harry A. Lowry Associates, Sun Valley, California.

B. Fire Rated: equal to Putty Pads manufactured by Specified Technologies, Inc.

PART 3 - **EXECUTION**

3.1 GENERAL

A. Provide raceways for all systems. 277/480V wiring shall be kept independent of 120/208V wiring. Emergency system wiring shall be kept independent of other wiring systems. Provide insulated grounding conductor in non-metallic raceways. Minimum conduit size shall be ½-inch. Wiring of each type and system shall be installed in separate raceways.

B. Protect metallic raceway in earth or fill from corrosion with two coats of corrosion-resistant paint or tape wrap.

C. Elbows for conduit installed below grade or embedded within floor slabs shall be rigid steel conduit with two coats of corrosion-resistant paint, tape wrap, or plastic-coated rigid steel conduit. Horizontal elbows that remain embedded in concrete and do not enter from grade below or exit into building above are permitted to be PVC.

D. Tie embedded raceways securely in place prior to concrete placement. Raceways installed below or within floor slabs shall extend a minimum of 4 inches above the finished slab or housekeeping pad to the first connector. Install capped bushings on conduit stub ups.

E. Branch circuit conduits or wiring device conduits for miscellaneous systems shall not be installed below slab on grade or embedded within floor slabs in tenant areas.

F. Locate raceways so that the integrity of structural members is not affected and they do not conflict with the services of other trades. Draw up couplings and fittings full and tight. Protect threads from corrosion after installation with zinc chromate or equivalent protection.

G. Conceal raceways except at surface-mounted cabinets and freestanding equipment. Install minimum of 6 inches from flues, steam pipes, or other heated lines. Provide flashing and counter-flashing for waterproofing of raceways which penetrate the roof. Install power raceways a minimum of 24 inches from telecommunications raceways, cross at 90-degree angle. Route exposed raceways and raceways above suspended ceilings parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Provide sleeves in concrete walls, floor slabs and partitions. Waterproof sleeved raceways where required.

H. Provide raceway expansion joints for exposed and concealed raceways at expansion joints and between structures to compensate for differential movement. Provide bonding conductor.

I. Provide one empty ¾-inch raceway for each three spare unused poles or spaces of flush-mounted panelboards. Terminate conduit in an accessible location for future extension.

J. Provide raceways with appropriate seal-offs, explosion-proof fittings, etc. in special occupancy areas as required. Provide conduit seal-offs where portions of an interior raceway system pass through walls, ceilings or floors which separate adjacent rooms having substantially different maintained temperatures, refrigeration, or cold storage rooms.

K. Provide pull cord in empty raceways. Tag both ends noting destination.

L. Clear raceway of all obstructions and dirt prior to pulling in wires or cables. Use ball mandrel (diameter approximately 85 percent of conduit insider diameter) followed by close-fitting wire brush and wad of felt or similar material. This assembly may be pulled with, but ahead of cable being installed. Clean empty raceways similarly. Clear or replace any raceway which rejects ball mandrel.

M. Install exterior underground conduits 24 inches minimum below finished grade. Do not penetrate waterproof membranes unless proper seal is provided.

N. Coordinate all exterior penetrations with waterproofing details and requirements.

O. Secure raceways clamps or supports to masonry materials with toggle bolts, expansion bolts, or steel inserts. Install raceway on steel construction with approved clamps which do not depend on friction or set-screw pressure alone.

P. Provide independent support of raceways larger than ¾ inch. Provide trapeze style support and threaded rod to structure above for multiple suspended raceways run together. Use of lathe channels, empty conduit or other miscellaneous steel to support raceways is not permitted. Use listed supports such as uni-strut or similar systems for support.

Q. Raceway installed on roofs shall be installed on sleepers/ rooftop support blocks complete with galvanized Unistrut for installation of raceway. Sleepers / rooftop support blocks shall be constructed of rubber.

R. Raceways Embedded in Floor Slabs:
   1. Raceways shall not be installed in slab without the approval of the Structural Engineer.
   2. Raceways shall not interfere with placement of floor slab reinforcement components.
   3. Install raceways between the upper and the lower layers of reinforcing steel.
   4. Space raceways not less than 8 inches on centers except where they converge at panels or junction boxes.
   5. Raceways running parallel to slabs supports, such as beams, columns and structural walls, shall be installed not less than 12 inches from such supporting elements.

S. Non-Metallic Raceway Installations:
   1. Joints shall be made using the material recommended by the raceway manufacturer.

Components shall be cleaned prior to assembly.
2. Raceway cutoffs shall be square and shall not deform conduit. Ream rough surfaces.
3. Provide male box adapters to terminate raceways.
4. Where separable terminations are required, provide PVC threaded adapters with locknuts or bushings. Provide “O” rings for watertight installations.
5. Bends shall be made by methods that do not deform or damage the conduit.
6. Provide expansion fittings where required.
7. Raceway supports shall be installed to allow the non-metallic conduit to slide through the supports.
8. Non-metallic raceway is not permitted within the building.
9. Must be UV resistant when installed in areas exposed to sunlight.

T. Raceways above Suspended Ceilings:
1. Single runs of ½-inch or ¾-inch raceways may be supported from ceiling support wires where permitted by the rating of the ceiling system.
2. Provide independent support of raceways larger than ¾ inch. Provide independent support of multiple raceways (more than one). Provide uni-strut support and threaded rod to structure above. Attachment to ceiling support wires is not permitted.
3. Provide independent support of raceways installed above fire-rated ceilings. Attachment to ceiling support wires is not permitted.
4. Install conduit 1 foot-0 inch minimum above top of ceiling.

U. Underground Duct Banks:
1. Provide underground duct banks as indicated. Provide concrete encasement of power systems duct banks except where duct banks run beneath building slab on grade. Provide concrete encasement of duct bank elbows for all systems. Provide steel reinforcing bars for concrete-encased duct banks. Provide spacers to permit concrete to completely surround and encase each conduit. Concrete strength shall be 3,000 pounds per square inch minimum. Provide red dye inhibiting agent in concrete mix.
2. Pitch conduit down and away where duct bank enters the building or equipment.
3. Support raceways installed in duct banks every five feet to assure correct alignment prior to placing concrete.
4. Terminate raceways with flared end bells. Clear raceway terminations of burrs and rough edges.

V. Conductors serving electric fire pumps shall be either in conduit encased in a minimum of 3 inches of concrete (concrete encasement is not required within fire pump room and electrical room where service originates), in conduit run beneath the slab on grade, or mineral-insulated cable.

W. Conduit connected to rotating or vibrating equipment shall be flexible metal conduit or liquid-tight flexible conduit.

X. Raceways and fittings installed in hazardous (classified) locations shall conform to NEC Article 500 requirements for the associated Class and Division.

3.2 2-HOUR RATED CABLE ASSEMBLIES

A. Two-hour rated cable assemblies are required for the following applications:
1. Fire alarm cabling
2. Fire pump feeders
3. Life safety and emergency feeders, including but not limited to stair pressurization systems and smoke exhaust systems.

B. Mineral Insulated Cable
1. Provide supports identified for such use at intervals not exceeding three feet so designed and installed as not to damage cable.
2. Where single conductor cables enter ferrous metal boxes or cabinets, the installation shall

be made to prevent inductive heating.

3. Provide seals immediately after stripping to prevent the entrance of moisture into the insulation. The conductors extending beyond the sheath shall be individually provided with an approved insulated material.

3.3 WIREWAYS AND AUXILIARY GUTTERS

A. Install wireways above suspended ceilings such that cover will hinge upward from side.

B. Provide 12 inches clear from wireway cover when in open position.

3.4 OUTLET, JUNCTION, AND PULL BOXES

A. Provide outlet, junction, and pull boxes as indicated and as required for a complete installation and to facilitate proper pulling of wires and cables. Boxes shall be sized per electrical code as minimum. Plug open knock outs.

B. The exact location of outlets and equipment is governed by field conditions. Where necessary, relocate outlets so that fixtures and equipment are symmetrically located in accordance with the room layout and will not interfere with other work or equipment. Verify final location of outlets, fixtures, and equipment with Architect.

C. Back-to-back outlets in the same wall, or “through-wall” type boxes are not permitted. Provide 12-inch minimum spacing for outlets shown on opposite side of a common wall. Provide acoustical potting compound (Electrical Box Pads) on outlet boxes installed in condominiums, private offices, conference rooms and in all sound-insulated drywall partitions. Install box pads on the outside of the box and fill all holes.

D. Fit outlet boxes in finished ceilings or wall with appropriate covers, set flush with the finished surface. Where more than one switch or device is located at one point, use multiple gang boxes and covers. Provide tile box or a 4-inch square box with tile ring in masonry walls not plastered or furred. Where drywall material is utilized, provide plaster ring. Provide outlet boxes of type and size suitable for the specific application. Provide barriers where required for voltage or systems separation.

E. Provide pull boxes so that an individual run of conduit does not contain more than the equivalent of four 90-degree bends (360 degrees total).

F. Boxes recessed in walls or ceilings with a surface of concrete, tile, gypsum, plaster, or other non-combustible material shall be installed so that the front edge of the box shall not be set back from the finished surfaces more than ¼ inch. Boxes recessed in walls and ceiling constructed of wood or other combustible surface material shall be flush with the finished surface.

G. Where boxes are installed in plaster, drywall, or plasterboard surfaces with cut openings for box installation, the cut openings shall be repaired so there shall be no gaps or open spaces greater than 1/8 inch at the edge of the box or fitting.

3.5 APPLICATION OF RACEWAYS

A. Rigid Steel Conduit:
   1. Where exposed to physical damage.
   2. Indoors where exposed to moisture.
   3. Where required by code.
   4. Exposed indoor installations within ten feet above finished floor.
   5. Exposed outdoor installations.

B. Electrical Metallic Tubing:
   1. General purpose feeders and branch circuits, except where another conduit type is specifically required.

2. Exposed indoor installations in branch electrical closets and telecommunications rooms below ten feet above finished floor.

C. Metal Clad Cable:
1. Use in dry locations concealed above suspended ceilings or within hollow partitions for lighting and receptacle branch circuits.

D. Flexible Steel Conduit:
1. Dry locations only.
2. Connections to lighting fixtures in suspended ceilings.
3. Connections to equipment installed in suspended ceilings.
4. Transformer connections.
5. Connections to equipment where vibration isolation is needed.
6. Maximum length shall be six feet.

E. Liquid-Tight Flexible Steel Conduit:
1. Same as flexible steel conduit in damp or wet locations.
2. Motor connections.

F. Rigid Non-Metallic Conduit:
1. Underground duct banks.
2. Below slab on grade.
3. Embedded in floor slabs.

G. Mineral Insulated Cable:
1. Fire pump feeders.

H. Wireways and Auxiliary Gutters:
1. Where indicated.
2. Above and below panelboards, lighting relay cabinets, fire alarm panels, and terminal cabinets to accommodate large concentrations of wires.

3.6 APPLICATION OF BOXES OUTLET, JUNCTION, AND PULL BOXES

A. Cast Type Boxes:
1. Where connected to rigid steel, intermediate metal, rigid aluminum conduit and liquid-tight flexible conduit, 1.25 inches and smaller.
2. Exposed conduit installations within ten feet above finished floor.
3. Where exposed to moisture and outdoors.

B. Galvanized Pressed Steel Type Boxes:
1. Where connected to electrical metallic tubing and flexible steel conduit, 1.25 inches and smaller.
2. Dry locations.
3. Where concealed in walls and above suspended ceilings.

C. Sheet Steel Boxes:
1. Where connected to conduit larger than 1.25 inches.

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