

SECTION 26 05 33 – RACEWAYS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of the raceway and work required by this section is indicated by Drawings and requirements of other sections of this Specification.
- B. Provide metal and nonmetallic conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated on plans. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements and comply with applicable portions of NEC for raceways.
- C. It is the intent of these Specifications and Drawings that all feeder wiring be run in a continuous conduit system. Type MC cables are permitted for lighting and power, branch circuits above ceilings and in stud walls, fishing existing walls, and connection to equipment/motors (2 feet max). In areas of exposed structure all wiring shall be run in conduit. At all locations where MC cable cannot be fished in an existing wall, surface (nonmetallic or metallic as specified) raceway shall be used. Finish of raceway shall be verified with the Architect before ordering. Surface raceway shall be screwed into the surface being installed at both ends and every 24" minimum along raceway. All surface raceway shall be run parallel and perpendicular to wall surfaces and run to blend in with surrounding equipment.
- D. Refer to Division 26, "Wires and Cables – 600V and Below" for acceptable uses of MC cables.

1.2 CODES AND STANDARDS

- A. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
- B. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical raceway systems; provide products and components which have been UL-listed and labeled.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of raceway systems.

PART 2 - PRODUCTS

2.1 CONDUITS

- A. Rigid Steel Conduit: Provide rigid steel, zinc-coated, threaded type conforming to FS WW-C-581, ANSI C80.1 and UL 6. Provide zinc-coating fused to inside and outside walls.
- B. Rigid Aluminum Conduit: Provide rigid aluminum, threaded type conforming to ANSI and UL standards.
- C. Intermediate Steel Conduit: Provide rigid intermediate grade (IMC) hot-dip galvanized threaded conforming to FS WW-C-581 and UL 1242.
- D. Electrical Metallic Tubing (EMT): FSW-C-563, ANSI C80.3, and UL 797.

- E. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- F. Flexible Metal Conduit: FS WW-C-566 and UL 1. Formed from continuous length of spirally wound, interlocked zinc-coated strip steel.
- G. PVC Heavy Wall Conduit: Schedule 40, 90C, UL-rated, constructed of polyvinyl chloride and conforming to NEMA TC-2, for direct burial, UL-listed and in conformity with NEC Article 347. PVC conduit may only be installed above finished grade, where specifically indicated on the drawings or within the specifications.
- H. PVC Light Wall Conduit shall not be acceptable under any circumstances. PVC Heavy Wall conduit shall be used when encased in concrete.
- I. No other type of conduit shall be used, unless otherwise noted, or prior approval granted by the engineer.

## 2.2 CABLE IN CONDUIT

- A. Cable In Conduit: Similar to "Draka", CIC (Cable in Conduit) may be used for exterior 20A applications only, including receptacles and area site lighting. Material shall be High Density, Polyethylene, Grade PE33, Class C in accordance with ASTM D3350 (latest addition) Schedule 40 and schedule 80. Duct shall meet the requirements of ASTM D2447 and NEMA standards publication TC7. Must be U.L. listed per standard 1990. The polyethylene duct shall be extruded directly around the cables in long continuous lengths. The single conductors as defined on the plans, shall be placed in parallel during the duct manufacturing process. Cable insulation must meet the intended use. Any other Cable in Conduit product shall be submitted for prior approval before bid.

## 2.3 CONDUIT FITTINGS

- A. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.
- B. Straight Terminal Connectors: Contractor shall provide one-piece body, with female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
- C. 45-Deg or 90-Deg Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
- D. Rigid Metal Conduit Fittings: Cast-malleable-iron, galvanized or cadmium plated, conforming to FS W-F-408. Use Type 1 fittings for raintight connections, Type 2 fittings for concrete tight connections, and Type 3 fittings for other miscellaneous connections.
- E. Rigid Aluminum Conduit Fittings: Provide cast-aluminum conduit fittings and mounting hardware conforming to ANSI and UL standards of types required for the application.
- F. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G. Provide cadmium-plated, malleable-iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.
- G. EMT Fittings: All couplings and connectors shall be of the compression type.
- H. PVC Heavy Wall Conduit and Tubing Fittings: Mate and match to conduit or tubing type and material.

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- I. Conduit and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes, and materials, complying with Manufacturers' published product information, which mate and match conduit and tubing.
- J. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes, and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded-conduit entrance ends, removable covers, either cast or galvanized steel, and corrosion-resistant screws.
- K. MC Fittings: The Snap2It connector with insulated throat as manufactured by Arlington may be used for MC cable connectors in lieu of the traditional cast fitting. However, these fittings may not be used for any other application.
- L. All raceway conduit and fittings above a ceiling shall be plenum rated.
- M. Press type fittings may not be used unless specifically specified to be acceptable elsewhere in the specifications or on the drawings.

2.4 WIREWAYS

- A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other components and accessories as required for complete system.
- B. Lay-In Wireways: Provide lay-in wireways with hinged covers, in accordance with UL 870 and with components UL-listed, including lengths, connectors and fittings. Design units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireways with knockouts.
- C. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached that removal is not necessary to utilize the lay-in feature.
- D. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.
- E. Raintight Troughs: Construct in accordance with UL 870, with components UL listed.
- F. Construction: 16-ga galvanized sheet metal parts for 4" x 4" to 6" x 6" sections, and 14-ga parts for 8" x 8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate or tear during installation, or would compromise raintight capability of the trough. Do not use cover screws that will protrude into the trough area and damage wire insulation.
- G. Finish: Provide 14-ga and 16-ga galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

2.5 SURFACE RACEWAY

- A. Provide single or dual channel surface raceway as specified on the drawings. Unless noted otherwise, raceway finish shall be selected at shop drawings from full list of standard and premium finishes.
- B. Device plates matching the raceway system shall be utilized. Standard wall mounted device plates shall not be acceptable.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Low voltage wiring in walls must be run in conduit system rated for 600V, as specified above. the use of flexible innerduct material in walls shall not be acceptable, unless specifically specified elsewhere. In new construction, conduits shall be rigid of appropriate type for the installation. In existing construction, flexible metallic conduit shall be used.
- B. Unless noted otherwise, all conduit shall be installed concealed in walls, under slabs, or above ceilings.
- C. Type MC cables shall be permitted only as noted.
- D. Unless noted otherwise, raceways and cables shall be installed near the structure and be supported independently from the structure. Support systems for other building systems (i.e. ductwork, HVAC equipment, system piping, ceiling supports, etc.) shall not be used to support conduits and cables. When routed from light fixtures and other system connections, raceways and cables shall be routed directly vertical to structure and across. Drop wire supports shall not be used on any ceiling support wires under any circumstances.
- E. Use PVC Schedule 40 conduit where circuits, feeders and service conductors are embedded in concrete, masonry, or earth, and use rigid galvanized steel elbows with large sweep elbows wherever turns are needed (**do not use PVC elbows**). Where PVC conduit is installed below finished floor level within the building pad, contractor shall transition to IMC or rigid galvanized steel at the elbow and rise to above floor slab. Where PVC conduit is used exterior to the building under finished grade, contractor shall transition to galvanized rigid steel conduit at the elbow up, and continue using galvanized rigid steel along the riser to above finished grade.
- F. PVC Schedule 40 conduit may be run in CMU wall cavities when originating from below finished grade and terminating at a recessed box no higher than 48" above finished floor or grade. For all other installations within wall cavities, PVC conduit shall not be used.
- G. Use rigid aluminum conduit where installed exposed outdoors.
- H. Use EMT conduit in mechanical equipment rooms, electrical equipment rooms, penthouses, crawl spaces, walls, and areas above ceiling.
- I. Use flexible metal conduit in moveable partitions and from outlet boxes to recessed lighting fixtures, and final 24" of connection to motors, or control items subject to movement or vibration, and in cells of precast concrete panels. Conduit size shall be increased as required to fit wiring per NEC.
- J. Use liquid-tight flexible metal conduit in mechanical spaces. Conduit size shall be increased as required to fit wiring per NEC.
- K. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.
- L. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameters.
- M. Size conduits to meet NEC, except no conduit shall be smaller than 3/4" on this project.
- N. Fasten conduit terminations in sheet metal enclosures by two locknuts, and terminate with bushing. Install locknuts inside and outside enclosure. **Metallic insulating conduit bushings shall be used on all power conduits.** Split bushings shall **not** be acceptable.

- O. Conduits are not to cross pipe shafts or ventilating duct openings.
- P. Keep conduits a minimum distance of 6" from parallel runs of hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.
- Q. Support riser conduit at each floor level with clamp hangers.
- R. Use of running threads at conduit joints and terminations is prohibited.
- S. Where required, use 3-piece union or split coupling.
- T. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
- U. For concrete floors-on-grade, install PVC Schedule 40 conduits under concrete slabs.
- V. Install underground conduits minimum of 24" below finished grade.
- W. Install conduits so as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
- X. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.
- Y. **Conduits shall not be installed against roof deck. Allow minimum 3" space between top conduit and roof deck for the possible penetration of roof nails to protrude without damaging conduit.**
- Z. In finished spaces without ceilings (i.e. gymnasiums, natatoriums, etc.), conduits shall be installed as high as possible, while meeting other requirements within these specifications. Conduits along bottom cord of open joists shall not be acceptable. Where conduits need to be installed along bottom of joists or beams, they shall be installed against walls.
- AA. Provide fish wire or pull string in all spare conduits.
- BB. Cap all spare conduits installed for future use.
- CC. Install surface metal raceways in corners or walls or conceal as much as possible.
- DD. There shall be no more than three (3) 20A branch circuits installed in a single 3/4" conduit. Each circuit shall be provided with a dedicated neutral wire. Sharing of neutral wire for multiple circuits will not be permitted.
- EE. At locations where conduits are installed after painting is done, the contractor shall be responsible to go back and paint conduit and boxes same color to match. At locations where there is no General Trades painting, this Contractor shall be responsible to paint conduit and boxes to match adjacent surfaces.
- FF. Metallic and non-metallic raceway shall be mechanically fastened to surfaces at intervals as recommended by the manufacturer. Under no circumstances shall glue, two-sided tape, or other type of adhesive be the only means of attachment.
- GG. For exterior wall or foundation penetrations, seal around conduits/sleeves and annular space between sleeve and conduits to limit water migration.
  - 1. Select seal material to fit the installation location, and ensures no degradation of the sealing material over time due to environmental conditions including, but not limited to continuous ground or rain

water, solar impact, temperature changes, freezing, etc. Where exposed, sealing compound shall match adjacent surfaces in texture and color.

HH. Installation through walls:

1. Where conduits are installed to pass through existing walls, the wall shall be cored to allow the conduit to be installed through the wall, and fire calk installed around the conduit.
2. Where MC cable is installed through a wall, an EMT sleeve of sufficient size to fit all of the MC cables shall be installed through a core in the wall, fire calk installed around the sleeve, and fire putty installed around the MC cables.
3. Should the contractor break out blocks, or cut an opening in the wall, not using a properly sized hole saw, he shall provide an appropriately sized lintel to maintain structural integrity of the wall, patch the wall by toothing in new block, new drywall sheet, or other means matching the wall material, and provide fire calk around the conduit or sleeve in the opening.

3.2 CONDUITS IN CONCRETE SLABS

- A. Conduits installed in concrete slabs will not be permitted. PVC conduits shall be installed under concrete slabs in stone base minimum 4" below to top of conduit.
- B. Conduits installed in elevated slabs will not be permitted. Conduits shall be installed in ceiling plenum spaces below elevated slabs.

3.3 EXPOSED CONDUITS

- A. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
- B. Install exposed conduit work as not to interfere with ceiling inserts, lights, or ventilation ducts or outlets.
- C. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed following: Up to 1": 6'-0"; 1-1/4" and over: 8'-0".
- D. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
- E. Cap all spare and active conduits stubbed up from the floor with secure PVC caps. Caps used for active conduits shall be notched to accommodate the quantity and size of cables installed in each conduit.
- F. Where possible, exposed conduits shall be run along walls and at 3" from roof deck. Care shall be given to avoid creating a ledge of conduits along bottom of steel.
- G. Where exposed conduits are installed outside of spaces labeled as electrical or mechanical, they shall be prepped and painted with appropriate products to match adjacent surfaces, unless specifically stated, in writing, by the architect/engineer/owner that they may remain unfinished.

3.4 NON-METALLIC CONDUITS

- A. Make solvent cemented joints in accordance with recommendations of Manufacturer.
- B. Install PVC conduits in accordance with NEC and in compliance with local utility practices. Provide expansion joints as required by Manufacturer and NEC.

3.5 CONDUIT FITTINGS

- A. Construct locknuts for securing conduit to metal enclosure with sharp edges for digging into metal, and ridged outside circumference for proper fastening.
- B. Bushings for terminating conduits smaller than 1-1/4" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.
- C. Install insulated type bushings for terminating conduits 1-1/4" and larger.
- D. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
- E. Bushing of standard or insulated type to have screw type grounding terminal.
- F. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs to be specifically designed for their particular application.

3.6 RACEWAYS AND WIREWAYS

- A. Avoid use of dissimilar metals through system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
- B. Install expansion fittings in all raceways/wireways wherever structural expansion joints are crossed.
- C. Make changes in direction to raceway/wireway run with proper fittings, supplied by raceway Manufacturer. No field bends of raceway/wireway sections will be permitted.
- D. Properly support and anchor raceways/wireways for their entire length by structural materials. Raceways are not to span any space unsupported.
- E. Use boxes as supplied by Manufacturer wherever junction, pull or device boxes are required. Standard electrical "handy" boxes, etc., shall not be permitted for use with surface installations.

END OF SECTION 26 05 33