

SECTION 26 11 00 – RACEWAYS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents

1.2 DESCRIPTION OF WORK

- A. This section includes minimum requirements for the following:

1. Rigid Metal (Steel) Conduit (RMC)
2. Electrical Metallic Tubing (EMT)
3. Flexible Metal Conduit
4. Liquidtight Flexible Metal Conduit
5. Rigid Non-Metallic Conduit
6. PVC Coated Rigid Galvanized Steel conduit
7. Fittings and Conduit Bodies
8. Expansion Fittings
9. Wireway and Wire Trough

1.3 QUALITY ASSURANCE

- A. All raceways shall be UL listed and installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed.. Where "approved equivalent" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Materials specified herein shall comply with the latest applicable requirements of:
1. The following Articles of the National Electric Code (NFPA 70)
 - a) 300 - Wiring Methods
 - b) 314 - Outlet, Device, Pull And Junction Boxes, Conduit Bodies, Fittings and Manholes
 - c) 344 - Rigid Metal Conduit
 - d) 348 - Flexible Metal Conduit
 - e) 350 - Liquidtight Flexible Metal Conduit
 - f) 352 - Rigid Nonmetallic Conduit
 - g) 354 - Nonmetallic Underground Conduit with Conductors
 - h) 358 - Electrical Metallic Tubing
 - i) 360 - Flexible Metallic Tubing
 - j) 362 - Electrical Nonmetallic Tubing
 - k) 366 - Auxiliary Gutters
 - l) 376 - Metal Wireways
 - m) 386 - Surface Metal Raceways

2. The following National Electrical Manufacturers Association (NEMA) Standards:
 - a) NEMA , RN1, PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - b) NEMA, TC 3, PVC fittings for use with Rigid PVC Conduit and tubing.
 - c) NEMA, TC 6, PVC and ABS Plastic Utilities Duct for Underground Installation.
 - d) NEMA, TC 8, Extra strength PVC Plastic Utilities Duct for Underground Installation.
 - e) NEMA, TC 9, Fittings for ABS and PVC Plastic Utilities Duct and Fittings for Underground Installation.
 - f) NEMA, TC 10, PVC and ABS Plastic Communications Duct and fittings for Underground Installation.
3. The following American National Standards Institute (ANSI) standards:
 - a) ANSI-C80.2, Specification for Rigid Steel Conduit, Enameled
 - b) ANSI-C80.3, Specification for Electrical Metallic Tubing, Zinc-coated
4. The following U.L. Standards:
 - a) UL 1, Flexible Metal Electrical Conduit
 - b) UL 3, Flexible Nonmetallic Tubing for Electric Wiring
 - c) UL 5, Surface Metal Electrical Raceways and Fittings
 - d) UL 6, Rigid Metal Electrical Conduit
 - e) UL 360, Liquidtight Flexible Steel Conduit, Electrical
 - f) UL 514B, Fittings for Conduit and Outlet Boxes.
 - g) UL 651, Schedule 40 and 80 PVC Conduit
 - h) UL 797, Electrical Metallic Tubing
 - i) UL 870, Electrical Wireways, Auxilliary Gutters and Associated Fittings

1.4 SUBMITTALS

- A. Provide five (5) sets or electronic files of product data for the following:
 1. Raceways
 2. Fittings
 3. Boxes, Enclosures, Terminal Cabinets
- B. Provide coordination drawings indicating locations of cable tray, underfloor raceways, and large feeder conduit runs as called for in General Electrical Requirements, Section -260100.
- C. Provide factory drawings detailing surface raceway and underfloor raceway installations.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Metal Conduit

1. Shall be hot-dipped galvanized steel, including threads.
2. Acceptable manufacturers:
 - a) Republic
 - b) Triangle
 - c) Allied Tube
 - d) Steel Duct
 - e) Wheatland
 - f) Approved Equivalent

B. Electrical Metallic Tubing

1. Electrical Metallic Tubing shall be electro-galvanized steel.
2. Acceptable manufacturers:
 - a) Triangle
 - b) Wheatland
 - c) Allied Tube
 - d) Steel Duct
 - e) Republic
 - f) Approved Equivalent

C. Flexible Metal Conduit

1. Flexible Metal Conduit shall be constructed of one continuous length of spirally wound, interlocked, zinc coated strip steel. Interior surface shall be free from burrs or sharp edges.
2. Acceptable manufacturers:
 - a) Anaconda
 - b) American Flexible Conduit Co.
 - c) O-Z/Gedney
 - d) Thomas and Betts
 - e) Approved Equivalent

D. Liquidtight Flexible Metal Conduit

1. Flexible Metal Conduit shall be constructed of one continuous length of spirally wound, interlocking zinc coated strip steel. Interior surfaces shall be free from burrs and sharp edges. Provide with a liquid-tight jacket of flexible polyvinyl chloride (PVC).
2. Acceptable manufacturers:

- a) Allied
- b) American Flexible Conduit
- c) Carlon
- d) Thomas and Betts
- e) Approved Equivalent

E. Rigid Non-Metallic PVC Conduit

- 1. Extra-Heavy wall conduit: Schedule 80, constructed of polyvinyl chloride, rated for use with 90 degree C conductors, and UL listed for direct burial and normal above ground use.
- 2. Heavy wall conduit: Schedule 40, constructed of polyvinyl chloride, rated for use with 90 degree C conductors, and UL listed for direct burial and normal above ground use.
- 3. Acceptable manufacturers:
 - a) Carlon
 - b) Thomas & Betts
 - c) Certainteed
 - d) Condux
 - e) Approved Equivalent

F. Fittings

- 1. Rigid galvanized steel fittings shall be fully threaded and shall be of the same material as the respective raceway system.
- 2. Fittings for electrical metallic tubing shall be steel, single screw indenter fittings for conduits up to 1" and double screw indenter fittings for conduits 1 1/4" and larger.
- 3. Fittings for flexible metal conduit shall be center stopped, insulated throat, U.L. E-11852 listed.
- 4. Fittings for liquidtight flexible metal conduit shall have zinc plated steel ferrule, compression type with sealing ring and insulated throat.
- 5. Fittings for rigid non-metallic conduit shall be solvent cemented in accordance with the manufacturer's instructions.
- 6. Fittings for PVC coated rigid galvanized steel conduit shall be threaded, hot dipped galvanized, and coated inside and outside with a urethane coating.
- 7. Connectors shall have insulated throat up to and including 1" size. For sizes 1-1/4" and larger, provide plastic insulating bushing.
- 8. Die-cast or pressure cast fittings are not permitted.
- 9. Provide conduit bodies types, shapes and sizes as required to suit application and NEC requirements. Provide matching gasketed covers

secured with corrosion-resistant screws.

10. Acceptable manufacturers:

- a) O.Z. Gedney
- b) Steel City
- c) Thomas & Betts
- d) Crouse-Hinds
- e) Carlon
- f) Approved Equivalent

G. Expansion Fittings

- 1. Galvanized steel expansion joints for RGS or EMT conduit, PVC for PVC conduit.
- 2. Minimum 4" movement in either direction.
- 3. Weatherproof for outdoor applications.
- 4. At expansion joints in concrete pours, provide Deflection/Expansion fittings capable of movement of $\frac{3}{4}$ " in all directions from the normal.
- 5. Design Make: O.Z./Gedney, Type "AX" (exposed), "DX" (Concrete Pour)
- 6. Acceptable manufacturers:
 - a) O.Z./Gedney
 - b) Crouse-Hinds
 - c) Appleton
 - d) Approved Equivalent

H. Waterproofing Seals

- 1. Provide watertight expanding link-type seals for installation between the conduit and the sleeve or core drilled hole.
- 2. Design Make: Link Seal, or approved equivalent

2.2 CABLE HANGERS

- A. Provide prefabricated, zinc coated, carbon steel hangers designed specifically for Category 6 and Optical Fiber cable installations.
- B. Hangers shall have open top, rolled edges and a 2" diameter loop.
- C. Provide beam clamps, rod fasteners, flange clips and brackets as job conditions require.
- D. Design Make: Caddy "CableCat Clip" series.

PART 3 - EXECUTION

3.1 GENERAL

- A. Size raceways as indicated on the drawings. Where sizes are not indicated, raceways shall be sized as required by the National Electrical Code in accordance with the quantity, size, type and insulation of conductors to be installed.
- B. Minimum 1/2" trade size for branch circuit and fire alarm wiring.
- C. Minimum 3/4" trade size for voice/data outlets, television outlets, and branch circuit "Home Runs" to panelboards.
- D. Support raceways from building construction. Do not support raceways from ductwork, piping, or equipment hangers.
- E. Support outlet, pull, and junction boxes independently from building construction. Do not support from raceways.
- F. Install raceways parallel or perpendicular to building walls, floors and ceilings.
- G. Install raceways concealed except in the following areas:
 - 1. Mechanical Rooms
 - 2. Electric Rooms
 - 3. Manufacturing areas
 - 4. Garage or maintenance areas
 - 5. Unfinished basements or crawl spaces
 - 6. Unless noted otherwise
- H. Provide a full size ground conductor between all outlets and the established electrical system ground.
- I. Cut raceways square, ream ends to remove burrs, and bush where necessary.
- J. Coordinate all raceway runs with other trades.
- K. Do not install raceways within 6" of hot surfaces or in wet areas.
- L. Provide expansion fittings with external grounding straps at building expansion joints.
- M. Do not install conduit horizontally in concrete block or dry wall partitions.
- N. Arrange neatly to permit access to the raceway, outlet, pull, and junction boxes, and work installed by other trades.
- O. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Owner's Representative and receive written approval both as to location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary and may require additional reinforcement.

- P. Core drill, sleeve, and fire stop all penetrations through existing floors.
- Q. Support all raceways with malleable iron pipe clamps or other approved method. In exterior or wet locations, provide minimum 1/4" air space between raceway and wall. Secure raceway within 3 ft. of each outlet box, junction box, cabinet or fitting.
- R. Provide conduit seals and explosion proof devices as indicated on the plans and as dictated by the National Electrical Code for all hazardous locations indicated on the drawings.
- S. Provide continuous green ground wire in all RMC, EMT, flexible conduit, and non-metallic conduit.

3.2 CONDUIT

- A. Install with a minimum of bends and offsets. Bends shall not kink or destroying the interior cross section of the raceway. Factory made bends shall be used for raceways 2" trade size and larger.
- B. Provide at least one junction or pullbox for each 360 degrees of bends.
- C. Plug the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.
- D. Provide U.L. approved rain-tight and concrete-tight couplings and connectors.
- E. Secure within three feet of each outlet box, junction box, cabinet or fitting.
- F. Provide a #14 AWG fish wire in all "Spare" or "Empty" conduit runs to facilitate future installation of conductors.
- G. Install raceways in concrete floor slabs as follows:
 - 1. All conduit in concrete floor slabs shall be rigid metal conduit with concrete tight threaded fittings.
 - 2. Provide expansion fittings where conduits cross building expansion joints.
 - 3. Install conduit below the reinforcing mesh.
 - 4. Locate conduits to provide a minimum of 1" of concrete around conduit.
 - 5. Obtain approval from the Owner's Representative prior to installing conduit larger than 1" trade size in concrete slabs.
- H. Wherever a cluster of four (4) or more conduits rise out of floor exposed, provide neatly formed 4 in. high concrete envelope, with chamfered edges, around raceways.
- I. Provide conduit supports based on the following table:

Conduit	Horizontal	Vertical
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Trade Size	Type of Run	Spacing in Feet	Spacing in Feet
1/2" , 3/4"	Concealed	8	10
1" , 1-1/4"	Concealed	8	10
1-1/2" & larger	Concealed	10	10
1/2" , 3/4"	Exposed	8	10
1" , 1-1/4"	Exposed	8	10
1-1/2" & larger	Exposed	10	10

- J. Where conduits puncture roof, install pitch pockets as required in order that the roof warranty is maintained.
- K. Provide 4 spare 3/4-in. raceways from each flush mounted panelboard or cabinet to an area above the nearest accessible ceiling space. Make 90° turn above the ceiling, arranged for further continuation of raceway, and cap.
- L. Conduit System Installation:
 - 1. Wiring below 600 volts, interior locations:
 - a) Electrical Metallic Tubing
 - b) Rigid Metal (Steel) Conduit in mechanical rooms, electrical rooms, maintenance areas.
 - 2. Wiring below 600 volts, exterior, above grade locations and hazardous locations :
 - a) Rigid Metal Conduit
 - 3. Wiring below 600 volts, below grade:
 - a) PVC Schedule 80,direct buried

3.3 UNDERGROUND DUCT

- A. Refer to section 261000 for information on Excavation and Backfilling.
- B. Encase all underground raceways in concrete or sand bed envelopes as noted on contract documents. Where concrete is called for, form concrete envelope around raceways, 3" minimum thickness concrete at top, bottom and sides of raceways, conduits on 7-1/2" centers both directions with concrete between raceways. Top of concrete envelope shall be finished not less than 24" below finished grade, except where under building slabs. Open trench for its complete length before concrete is poured; if any obstructions are encountered, make provisions to avoid them. Support raceways minimum 3" above bottom of trench before pouring. Furnish and install precast concrete, plastic or fiber spacers. Stagger couplings.
- C. When concrete is specified, securely tie raceways in place to prevent floating. Pour concrete as soon as possible after placing and securing of raceways. Pull iron-shod mandrel, not more than 1/4" smaller than bore of raceway to remove concrete and other obstructions. Clean raceway by drawing through properly sized cylindrical brushes as many times as necessary to remove dirt.

- D. Concrete envelopes shall contain reinforcing rods wherever non-metallic raceways are used. Reinforcing shall be continuous runs of No. 4 deformed rods located in all four corners as well as top and bottom of envelope between each raceway.
- E. In locations where non-metallic raceways are used, change to heavy wall metallic conduit of same internal diameter before rising out of ground; provide metallic conduit elbows at conduit rise.
- F. Carry concrete envelope to a point 12 inches minimum above grade or floor slab at rise point if allowed by site conditions and equipment to be installed. Slope top of concrete away from raceway, chamfer edges. Where raceways rise above grade and terminate in building, provide conduit sealing bushing on each raceway.
- G. Place conduit in straight lines. Seal, completely waterproof, all duct joints, then complete concrete encasement. Place direct-bury conduit tier-by-tier method, backfilling each layer to achieve proper spacing. Elbows shall have a minimum radius of 42 in. Follow proper low temperature installation procedures as recommended by PVC conduit vendor. Repair or replace all existing utilities and facilities damaged, due to ductbank installation, as part of contract.
- H. Provide a bushing at each conduit termination unless fitting at box where conduit terminates has hubs designed in such a manner to afford equivalent protection to conductors. Provide grounding type insulated bushings on all conduit sizes 1-1/4" trade size and larger, and on all feeder raceways regardless of size. Provide standard bushings for conduits 1" and smaller unless otherwise stated.

3.4 FLEXIBLE METAL CONDUIT and LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. FMC and LFMC may be used in concealed for drops to recessed lighting fixtures, outlets and branch circuit wiring in partition walls.
- B. FMC and LFMC may be used in exposed areas above drop ceilings with a maximum length of six (6) feet and in equipment rooms or for the connection of vibrating equipment with a maximum length of two (2) feet up to trade size 1" and three (3) feet over trade size 1".
- C. FMC and LFMC shall not be used for multi-wire branch circuits, switch legs, homeruns or to pass through walls and floors.
- D. Provide UL approved compatible fittings and supports as required to make a complete system.

END OF SECTION

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