SECTION 16110 – RACEWAYS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Rigid Metal conduit.

B. Liquid tight flexible metal conduit.

C. Fittings and conduit bodies.

1.02 RELATED SECTIONS

A. Section 16050 – General Electrical Requirements.

1.03 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

C. ANSI/NFPA 70 - National Electrical Code.

D. NECA "Standard of Installation."

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Section 01180 – Equipment, Materials, Parts, and Tools.

B. Accept conduit on site. Inspect for damage.

C. Conduit shall be delivered at the construction site in not less than ten foot lengths; each length of conduit to have approval label of the Underwriters.

D. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.05 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

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

C. Conduit routing that is shown on Drawings in approximate locations, unless dimensioned. Route as required to complete the raceway system.

PART 2 - PRODUCTS

2.01 CONDUIT AND FITTINGS

A. Provide all conduit, conduit fittings, outlet boxes, pull boxes, supports, hangers, plates, and such other items as are incidental to or required for a complete installation, all of which shall be made of cast iron, malleable iron, or galvanized steel.

B. No threadless couplings or running threads will be permitted on rigid conduits.

C. No conduit smaller than 3/4 inch shall be used, unless otherwise indicated or specified.

D. All raceways shall be marked with the manufacturers name or trademark as well as type of raceway and size. This marking shall appear at least once every 10 feet and shall be of sufficient durability to withstand the environment involved.

E. Wherever conduits cross building or other structural expansion joints, the Contractor shall provide and install conduit expansion/deflection fittings as manufactured by O.Z./Gedney Type DX, Crouse-Hinds, or equal, unless indicated on the Drawings as requiring an expansion fitting.

F. Expansion fittings with copper, ground-bonding jumpers shall be installed where indicated on the Drawings and shall be O.Z./Gedney Type AX with Type BJ bonding jumper, Crouse-Hinds, or equal.

2.02 RIGID METAL CONDUIT

A. Rigid steel conduits shall consist of heavy wall, mild steel tube, hot-dipped galvanized with threads electrogalvanized after cutting, and especially selected with reference to uniformity of thickness and freedom from defects. All fittings shall be suitable and approved for use in rigid steel conduit systems.

B. Manufacturers:

1. Triangle PWC, Inc.

2. Wheatland Tube Company

3. Allied Tube & Conduit Corporation

C. Rigid Steel Conduit: ANSI C80.1.

D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; all steel fittings.

2.03 MISCELLANEOUS FITTINGS

A. Insulated grounding bushings shall be Type HBLG as manufactured by O.Z./Gedney, Anderson Co., or equal.

B. Insulating bushings shall be high impact resistant, thermoset plastic, 150 ^{0}C rated, Type A as manufactured by O.Z./Gedney, Anderson Co., or equal.

C. All locknuts shall be of the sealing type, O.Z./Gedney Type SLG, Appleton, or equal.

D. Liquid tight hubs shall have a sealing ring between the fitting and the box and an insulated throat to insure protection of the wires as pulled. Hubs shall be made of nodular or malleable iron steel; zinc plated for corrosion resistance, UL listed, and shall meet or exceed the requirements of UL test 514B. Liquid tight hubs shall be Bridgeport, O.Z./Gedney Type CH-T, Ideal Industries 75-000 Series, or equal.

E. Link seal for sealing conduits into sleeves and cored openings shall be Thunderline Corp. Model No. S, Metraflex Co. Metraseal, Calpico, or equal.

2.04 LIQUID-TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit

1. Conduit shall meet UL 360.

2. Conduit shall be single strip interlocking type.

3. Acceptable Manufacturers (Conduit):

a. American Brass Co. –“Sealtite”
b. Electri-Flex Co. – “Liquidtite”
c. Or equal

B. Fittings

1. Fittings for liquid-tight flexible metal conduit shall meet ANSI/NEMA FB 1.

2. Fittings shall be:

   a. Liquid-tight
   b. Grounding type.

3. Acceptable Manufacturers (Fittings):

   a. Appleton Electric Co. – Series “ST”
   b. Crouse-Hinds-Series “LT”
   c. Or equal.

2.05 PVC CONDUIT AND FITTINGS

A. PVC conduit and fittings shall be schedule 80, gray PVC suitable for direct burial or encasement in concrete, rated for 90°C conductors.

B. PVC conduit and fittings shall be UL listed.

C. Acceptable Manufacturers:

1. Carlon

2. Or equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF RACEWAYS

A. Install conduit in accordance with NECA "Standard of Installation."

B. Arrange supports to prevent misalignment during wiring installation.

C. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

D. Arrange conduit to maintain headroom and present neat appearance.

E. Identify raceway systems under provisions of Section 16195-Electrical Identification.

F. Joints shall be made tight with standard couplings and corners turned with elbows or long radius bends in pipe.

G. Exposed multiple runs of conduit indoors shall be supported on hangers suspended from concrete inserts or structural steel. Single runs of conduit may be attached to ceilings or walls by means of approved type anchors. Conduit and other equipment may be attached to structural steel only where approved by the Engineer. All conduits shall be secured to the supports by means of galvanized malleable iron clamps using two bolts or machine screws.

H. The use of wood plugs for anchoring raceways to concrete or masonry will not be permitted.

I. All conduits installed exposed shall be run vertically or horizontally and shall be parallel or at right angles to the building or structure walls.

J. The Contractor shall provide and install, where required, the additional steel to adequately support all conduits, boxes, and all other electrical equipment.

K. Before conductors are pulled in, all conduits shall be dry, clean, and free of obstructions. If there is evidence of moisture, obstructions, or foreign matter in the conduit when the conductors are installed, the wiring shall be removed and the conduit cleaned to the satisfaction of the Engineer. All wiring showing evidence of damaged insulation shall be replaced.

L. All steel conduits run exposed shall be supported at intervals not exceeding 8 feet, unless shown otherwise on the Drawings. Multiple runs of conduit shall be mounted with steel supports so arranged that each individual conduit is clamped in place.

M. Conduit installed on walls shall be mounted on spacers to provide not less than 1/4-inch space between the conduit and the wall.

N. Conduit installed exposed outdoors shall be supported by structural steel members.

O. All conduits passing through openings or sleeves in roofs, below grade walls, or floors shall be sealed in place and made watertight with link seal.

P. All conduit stubs for future use shall be terminated with pipe caps.

Q. Conduit runs installed horizontally overhead shall allow a minimum of 7 feet of headroom, except where installed along structures, piping, equipment, or in other areas where headroom cannot be maintained because of other considerations.

R. Wherever a conduit emerges from the underside of a slab or roof or enters an area from above and that slab or area or conduit is exposed to the weather, then that conduit shall be provided with a pull box or fitting and filled to a length of 12 inches minimum with conduit sealing compound where the conduit emerges indoors to prevent water from following the conduit interior.

S. Field bends in conduit shall not be of a lesser radius than that of manufactured elbows of the same trade size and shall show no flattening of the conduit. Conduit bends shall be held to as large a radius as possible for ease in pulling of conductors and to provide a neatly installed appearance. Generally, conduits 1" and smaller shall be bent in the field. Other conduit bends shall conform to the following: 2" and 2-1/2" conduit, 24" radius; 3" and larger, minimum 36” radius. Except where conduit runs are shown in exact detail on Drawings, the maximum length of straight conduit runs shall be 200 ft. between pull boxes, with 50 ft. deducted for each 90-degree bend and 25 ft. deducted for each 45-degree bend, reduction in length for all other angle bends shall be figured on a similar basis.

T. Conduit parallel to or crossing uninsulated hot water or steam pipes shall be separated from same by 12", if parallel, or 7", if crossing. Where hot water or steam pipelines are insulated, conduit shall clear the insulation surface by 2". Conduit shall not run directly under cold water lines.

U. Conduit stub-ups into the bottom of NEMA Type 12, floor mounted enclosures shall enter the enclosure through individual holes in the bottom plate or sheet steel bottom and the openings shall be sealed around each conduit to maintain the enclosure's NEMA Type 12 rating.

V. All conduits and sleeves passing through openings in walls above grade or floors shall be sealed in place and made watertight with non-shrink grout or other sealant approved by the Engineer. Non-shrink grout used in floor or wall openings shall be of the non-metallic type. All openings in fire rated walls and floors shall also be sealed with a fire barrier sealing system capable of maintaining the designed fire rating of the wall or floor and suitable for sealing out smoke and fumes. The fire barrier sealing system shall be capable of passing the ASTM E-814 (UL 479) fire test and shall be 3M Fire Barrier System or equal installed per manufacturer's instructions.

W. Openings in boxouts through floors or walls or in the bottom of electrical equipment shall be closed using split insulating blocks or non-shrink grout in a manner as approved by the Engineer. All unused sleeves shall be capped or plugged at both ends with approved fittings.

X. Sleeves containing a ground conductor shall be bonded at each end to the ground conductor.

Y. The ends of all conduits or elbows shall be cut square, reamed, and threaded.

Z. The threads of all outdoor and below grade equipment connections including conduit, conduit fittings, pull and junction box covers, lighting fixture reflector, guard, and outlet box connections, wiring device boxes, etc. shall be coated with an anti-seize, lubricating, and protective compound prior to final assembly. Coating compound shall be Never-Seez as manufactured by Bostik Div. of Emhart Corp., "Dry Molybdenum Lubricant" No. 40-640 by Ideal Industries, CRC Chemicals Lectra-Shield, or equal.

AA. All metallic conduits, except those terminated in metal boxes or enclosures without knockouts and secured with double locknuts, integral hubs, or liquid tight hubs, shall be terminated with insulated grounding bushings. Conduits terminated in metal boxes or enclosures without knockouts and secured with double locknuts shall be terminated with an insulating bushing.

BB. All conduits not terminated in boxes, fittings, or enclosures, shall be terminated with a bushing.

CC. All connections between conduits and NEMA Type 1 or NEMA Type 12 steel boxes shall be made with double locknuts. All connections between conduits and NEMA Type 3, 3R, 4, and 4X boxes shall be made with watertight connections. Watertight connections shall consist of integral hubs or liquid tight hubs.

DD. Electrical metal tubing or so called "Thin Wall" conduit and fittings shall not be used.

EE. Flexible conduit may be used only where rigid conduit is impracticable or where indicated on the Drawings.

FF. Flexible Metal Conduit

1. Install the minimum length of flexible conduit that will prevent transmission of vibration.

2. Install no greater than a six-foot length of flexible conduit.

3. Install a bonding wire between the grounding bushings at each termination of the flexible conduit.

END OF SECTION 16110