SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

A. Description of System
   1. Provide raceway systems as required, and all equipment and material, including conduit, fittings, boxes, wireways, and cable trays, as indicated or specified.

1.2 SUBMITTALS

A. Furnish submittals for items that are identified in this SECTION by a different typeface and a bracketed code (e.g., *Item [L]*). Refer to SECTION 01340 for definition of codes for types of submittals and the administrative requirements governing submittal procedure. Additional submittal requirements pertaining to this SECTION are specified herein under this Article.

B. Include complete data on each item. Coordinate the items, as they relate to the work, prior to submittal.

1.3 OPERATION AND MAINTENANCE MANUALS

A. Provide, per SECTION 01730, Operation and Maintenance Manuals for systems and equipment.

PART 2 PRODUCTS

2.1 MATERIALS

A. Conduit
   1. Rigid Steel Conduit, Elbows, and Couplings: Zinc-coated threaded steel per ANSI C80.1 “Specification for Rigid Steel Conduit, Zinc-Coated”. Each length of conduit shall be threaded on both ends.
      a. Allied Tube and Conduit Corp.
      b. Condux International, Inc.
      c. Steelduct Conduit Products.
      d. Wheatland Tube and Conduit Corp.
      e. LTV Steel Tubular Products
   2. PVC Jacketed Rigid Steel Conduct, Elbows and Couplings:
      Zinc-coated threaded steel conduit per ANSI C80.1 “Specification for Rigid Steel Conduit, Zinc-Coated”, with an extruded black polyvinyl chloride coating, 40 mils thick, applied on the outside of the conduit. Each length of conduit shall be threaded on both ends.
      a. Electri-Flex Corp.

b. Robroy Industries

3. Electrical Metallic Tubing: Zinc-coated steel per ANSI C80.3 “Specification for Electrical Metallic Tubing, Zinc-Coated”.
   a. Allied Tube and Conduit Corp.
   b. Condux International, Inc.
   c. Steelduct Conduit Products.
   d. Wheatland Tube and Conduit Corp.
   e. LTV Steel Tubular Products
4. Flexible Metal Conduit: Per ANSI/UL 1, “Flexible Steel Conduit”.
   a. Anamet, Inc.
   b. Condux International, Inc.
   c. Electri-Flex Corp.
5. Liquid-Tight Flexible Steel Conduit: Per ANSI/UL 360, “Steel Conduits, Liquid-Tight Flexible”, with a PVC jacket.
   a. Anamet, Inc. “Sealtite Type UA only”
   b. Electri-Flex Corp.
   c. Thomas & Betts

B. Conduit Fittings
1. Outlet Bodies for Rigid Steel Conduit: Cast or malleable iron bodies, zinc-plated, with taper threads, screw attached cover plates, and gaskets when located in areas requiring gaskets as specified in ARTICLE “INSTALLATION”.
   a. Appleton Form 35
   b. Crouse-Hinds Form 8
   c. O-Z/Gedney Form 7
2. Expansion Fittings for Rigid Steel Conduit: Cast or malleable iron bodies, with threaded end caps for receiving fixed and movable conduits, metallic pressure packing and copper bonding jumper assembly, and providing for a minimum of 2 inch movement of the conduit in either direction.
   a. Appleton Type XJ
   b. Crouse-Hinds Type XJ
   c. O-Z/Gedney Type AX
3. Conduit Bodies for PVC Jacketed Rigid Steel Conduit: As specified for rigid steel conduit and with a 40 mil PVC coating on the outside.
   a. Robroy Industries
   b. Electri-Flex Corp.
4. Couplings and Connectors for EMT: Zinc-plated steel, compression or set screw type.
   a. Appleton
   b. Midwest Electric Product/Crouse-Hinds Company
   c. Raco
   d. Thomas & Betts
5. Conduit Unions; On Continuous Run:
   a. Appleton
   b. O-Z/Gedney
   c. Raco

6. Fittings for Flexible Steel Conduit: Malleable iron or steel, zinc plated, securing the conduit by clamping action around the periphery of the conduit. Do not furnish fittings that anchor the conduit by means of set screws.
    a. Appleton
    b. Steel City
    c. Thomas & Betts
7. Fittings for Liquid-Tight Flexible Steel Conduit: Designed to maintain the liquid-tight feature of the installation.
    a. Appleton ST Series
    b. Ideal Industries 75 Series
    c. Thomas & Betts 5000 Series
8. Locknuts for Rigid Steel Conduit: Malleable iron or steel, zinc plated.
9. Locknuts; for rigid steel conduit terminated in threadless openings; gasketed sealing locknuts.
    a. Appleton BLS Series
    b. Crouse-Hinds SL Series
    c. Raco 150SL Series
10. Bushings; for 1 Inch and Smaller Rigid Steel Conduits. Insulating plastic type of nonburnable thermosetting phenolic, conforming to Underwriters' Laboratories requirements. Do not furnish nonrigid plastic bushings.
11. Bushings; for 1-1/4 Inch and Larger Rigid Steel Conduits. Malleable iron or steel, zinc plated, with insulating insert of thermosetting plastic as specified for smaller conduit bushings, molded and locked into the bushing ring.
12. Bushings; for conduits terminated in threadless opening; threaded hub with watertight seal.
    a. Appleton HUB Series
    b. Meyer ST Series
    c. Raco 40 Series
    d. Thomas & Betts H Series

C. Outlet Boxes
1. Sheet Steel Boxes: Galvanized stock not less than No. 14 gage, with knockout openings, single or multiple gang, with extensions, adapters, plaster rings, tile covers, fixture studs and cover plates. Furnish accessories with same gage and finish as specified for boxes, except where special finishes are specified for covers and device plates in SECTION 16121. Provide sizes per NEC requirements for wiring space, except where minimum sizes are specified under ARTICLE "INSTALLATION".
    a. Appleton
    b. Raco, Inc.
    c. Steel City
2. Cast or Malleable Iron Boxes: Galvanized, single or multiple gang, with taper threaded hubs, adapters and cover plates. Furnish cast metal, galvanized accessories, except where special device plates are specified in SECTION 16121. Furnish gaskets when located in areas requiring gaskets as specified in ARTICLE "INSTALLATION". Provide sizes per NEC requirements for wiring space, except where minimum sizes are specified under ARTICLE "INSTALLATION".
    a. Appleton
    b. Crouse-Hinds

c. Pyle-National
d. O-Z/Gedney

D. Pull And Junction Boxes
1. Boxes Less than 5 Inches by 5 Inches. Conform to paragraph “OUTLET BOXES”.
2. Sheet Metal Boxes: Code gage, full seam welded with bent-in flanges seam welded at corner joints, screw fastened cover of same gage as box. Fasten cover with brass or stainless steel machine screws. Galvanize box and cover after fabrication. Provide sizes conforming to NEC requirements for wiring space, except where boxes of larger size are indicated. Furnish gaskets when located in areas requiring gaskets as specified in ARTICLE “INSTALLATION”.
3. Cast or Malleable Iron Boxes: Code gage, with threaded hubs or conduit bosses for field drilling and tapping, screw fastened cover of same gage as box. Fasten cover with brass or stainless steel machine screws. Galvanize box and cover after fabrication. Provide sizes conforming to NEC requirements for wiring space, except where boxes of larger size are indicated. Furnish gaskets when located in areas requiring gaskets as specified in ARTICLE “INSTALLATION”.
    a. Appleton
    b. Crouse-Hinds
    c. O-Z/Gedney

E. Wireways
1. *Wireways [U]*: Painted steel enclosure with hinged or screw fastened cover, bends, elbows, tees, crosses, adapters and accessories as required, easily assembled into a complete system. Provide sizes per NEC requirements for wiring space, except where larger sizes are indicated. Furnish gaskets when located in areas requiring gaskets as specified in Article, “INSTALLATION” for outlet boxes.
    a. Hoffman
    b. Keystone
    c. Square D

F. Miscellaneous
1. *Trapeze Hangers Support Channel [U]*: Shall be pregalvanized continuous C channel, 1-5/8” nominal. All associated hardware shall match support channel manufacturer.
    a. Kindorf
    b. Powerstrut
    c. Unistrut
    d. B-Line
    e. GS Metals
2. Joint Compound:
    a. Thomas & Betts “KopR-Shield” or “AlumA-Shield”
3. Rubber Calking:
    a. G. E. “Silicone”
    b. Dap, Inc. “Flexseal Two-Part Polysulfide Sealant”
    c. Pecora Corp. “GC-S Synthacaulk”
    d. Sonneborn “Sonolastic Two Part”
4. Fire-Barrier Calking:
    a. 3-M “CP25” and “Putty 303”

b. Nelson FSP Firestop Putty and Nelson CMP Firestop Compound
c. International Protective Coatings Corporation “Flamesafe” products.

5. Wire Identification Labels [U]:
   a. Brady
   b. Panduit
   c. Thomas & Betts
6. *Metallic Detection Tape [U]*: Non-adhesive, 0.035 inch, non-ferric metallized, 2 inch wide for burial at 4-6 inches below surface or 6 inch wide for deeper burial, polyethylene with **“Buried Electric Line Below”** wording and red color to assure visible detection.
   a. Seton Identification Products
7. *Underground Hazard Tape [U]*: Non-adhesive, 4 mil, polyethylene, 3 inch wide, black letters on red background with legend “CAUTION - ELECTRIC LINE BURIED BELOW”.
   a. Panduit
   b. Stranco Products, Inc.
   c. Thomas & Betts
   d. Seton Identification Products

PART 3 EXECUTION

3.1 INSTALLATION

A. Conduit Systems
   1. Install rigid steel conduit in general in all applications, except as otherwise specified or indicated. Use electrical metallic tubing, unless noted otherwise, in lieu of rigid steel conduit in concealed dry locations in office and similar finished areas. Do not use EMT in concrete floors in contact with earth, underground, or in utility areas.
   2. Install flexible conduit for service to individual recessed fixtures, 1/2 inch minimum size, and for final connection to distribution transformers and other equipment subject to vibration or movement. Use liquid tight type of flexible conduit in damp or wet locations and for final connections to all motors.
   3. Install conduit systems as indicated, as required by the NEC, and as specified. Install conduit sizes as indicated. Where conduit sizes are not indicated, install sizes per NEC requirements, except do not use conduit sizes smaller than 3/4 inch unless otherwise specified. Use 1/2 inch fixture stems unless otherwise indicated.
   4. Install conduit concealed in office and similar finished areas, and exposed in all other areas unless otherwise indicated or specified.
   5. Use PVC jacketed rigid conduit in corrosive areas as indicated.
   6. Install exposed conduit runs level and plumb parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Keep conduit at least six inches away from parallel runs of high temperature surfaces, such as steam or hot water pipes and do not run conduit directly under cold water lines.
   7. Encase conduit laid in earth below floor slabs, or in earth external to foundation walls and within 5 feet of same, with a 3 inch minimum concrete envelope around the conduit.
   8. Install hazard warning tape directly above conduit or duct bank and located 12 inches below finished grade. Where conduit is installed below finished floor slab, warning tape shall be placed within the top 4 inches below the slab.

9. Group conduit for common support, where indicated and elsewhere as directed by the ARCHITECT-ENGINEER.
10. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Take care to prevent the entrance of water and the lodging of concrete, plaster, dirt or trash in conduit, boxes, fittings and equipment during the course of construction. Free conduit of obstructions or replace the conduits. Where conduit joints occur in concrete slabs, or in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible. Cap exposed empty conduits which do not terminate in outlets, panels, cabinets, etc. with standard galvanized malleable iron pipe caps. Plug empty conduits which terminate flush with floors or walls with flush coupling and galvanized malleable plug. Coat the threads of pipe caps and plugs with anti-corrosive joint compound.
11. Install conduit sleeves for all exposed conduits and cables passing through walls, ceilings or floors, and fill the void between sleeve and conduit with rubber calking flush with the end of the sleeve to seal the opening; where fire rating is required, use fire-barrier calking.
12. Terminate conduit stubbed up through concrete floors for connections to free standing equipment with a coupling flush with finish floor and extend rigid conduit to equipment, except that where required, use flexible conduit from a point 6 inches above the floor.
13. Make changes in direction of runs with symmetrical bends, fittings or pull boxes. Do not use bends around outside corners; use fittings for same. Install elbows, bends and offsets having a minimum radius of curvature of 24 inches for 2 inch and 2-1/2 inch conduit, and 36 inches for 3 inch and larger conduit. Except where conduit runs are shown in exact detail, install pull points at not greater than 200 foot intervals in straight runs. Where bends are included between pull points, reduce this maximum permissible 200 foot separation between pull points by 50 feet for each 90 degree bend and 25 feet for each 45 degree bend. Figure deductions for all other angle bends on a similar basis. When bends are made in the field, make bends with an approved hickey or conduit bending machine. Make bends in 1-1/4 inch and larger conduits with standard conduit ells where possible.
14. Provide conduit nipples with two independent sets of threads. Do not use running threads on any part of the conduit system. Where conditions require joining two fixed conduits into a continuous run, use a conduit union, in place of running threads and coupling.
15. Install expansion fittings in exposed conduit runs of lengths greater than 200 feet, at each crossing of building expansion joints, and elsewhere as indicated.
16. Coat conduit threads in PVC jacketed rigid steel conduit with joint compound.
17. Install double locknuts and bushings on all rigid conduit terminations into threadless openings. Increase length of conduit threads at terminations sufficiently to permit the bushing to be fully seated against the end of the conduit. Use a threaded hub with watertight seal or a gasketed sealing locknut on all NEMA 12 applications and for all distribution boxes. Threads shall be per manufacturer's recommendation.
18. Use one hole malleable iron galvanized pipe straps for support of single conduits, or clevis type hangers. Support groups of conduit on trapeze hangers. Use threaded rod or pipe for hanger support. Do not use perforated strap or wire for conduit or hanger support. Use beam clamps of malleable iron or wrought steel with hook rods to grip the beam flange for conduit or hanger support; do not use C-clamp type fittings unless otherwise indicated on DRAWINGS. Support exposed conduit at least every 8 feet if smaller than 2 inch, and every 10 feet if 2 inch and larger unless otherwise noted.

19. Install nylon pull wire in empty conduits.

B. Outlet And Switch Boxes
   1. Outlet Boxes for Use with Rigid Steel Conduit in Nonhazardous Areas. Sheet steel for flush or concealed work in dry locations; cast or malleable iron in exposed, or damp or wet locations. Do not use sheet steel outlet boxes in utility or factory type areas.
   2. Outlet Boxes for Use with Electrical Metallic Tubing. Sheet steel for flush or concealed work; cast or malleable iron for exposed locations.
   3. Flush Mounted Boxes. For single outlets, use boxes not less than 4 inches square and 2-1/8 inches deep. For multiple outlets, use gang type boxes not less than 2-1/4 inches deep. Furnish plaster rings not less than 1-1/4 inches deep. In masonry walls use masonry boxes. For ceiling outlets in concrete slabs, use boxes not less than 3 inches deep.
   4. Gaskets. Provide cover gaskets for boxes in damp or wet locations.
   5. Install boxes in the wiring or raceway systems as required for pulling of wires, making connections, and mounting of devices and fixtures.
   6. Install extension rings, adapters, raised covers and plaster rings on flush mounted boxes as required. Equip flush mounted boxes in masonry block or tile walls with tile covers.
   7. Install separate concealed boxes for semi-flush or recessed fixtures when required by the fixture terminal operating temperature. Make boxes readily accessible on removal of the fixture or provide ceiling access panels as approved by the ARCHITECT-ENGINEER.
   8. Locate outlets in offices and other finished areas with due regard for the finish and interior architectural treatment so that outlets are centered with respect to panels, joints or moldings, and so that plaster rings, frames and tile covers are properly located with respect to the finished surface.
   9. Install outlets for wall switches controlling lighting on the latch side of door where possible.
   10. Support boxes independent of conduit and secure rigidly in place. Install boxes used for fixture support such that they are capable of carrying 100 pounds.
   11. In concrete, anchor boxes securely to reinforcing steel and to forms to prevent shifting when concrete is placed.
   12. Above suspended ceilings, support boxes independent of the ceiling; fasten boxes to the ceiling support system by bar hanger or similar support.

C. Junction And Pull Boxes
   1. Junction and Pull Boxes for use with Rigid Steel Conduit or Electrical Metallic Tubing in Non-Hazardous Areas. Sheet steel for exposed or flush work in dry locations; sheet steel with cover gaskets for work in dry locations of utility and factory areas; cast or malleable iron with cover gasket in damp or wet locations.
   2. Junction and Pull Boxes for use with Rigid Steel conduit in concrete. Cast iron with reinforced cover and sealing gasket flush mounted in light traffic areas.

D. Wireways
   1. Install wireways at locations indicated. Where wireways are located on surfaces, do not install wireway in contact with such surfaces; support wireways with not less than 1/4 inch separation from the surface.
   2. Provide supports at a maximum of 5 foot intervals.

3. Where pendent supports are indicated or required, provide 1/2 inch diameter threaded rods with beam clamps as specified for conduit supports. Provide lateral bracing at intervals not greater than 10 feet.

E. Equipment Identifications
   1. Provide identification labels for electrical equipment as indicated in Appendix "A" of this section.

END OF SECTION

Revision History	
Date	**Rev. No.**
A	0
B	0
D	0
E	0
F	0
02-19-09	0

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