SECTION 26 05 33
ELECTRICAL SYSTEM RACEWAY and BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Metal conduit
- B. Flexible metal conduit
- C. Liquid tight flexible conduit
- D. Electrical metallic tubing
- E. Non-metallic conduit
- F. Fittings and conduit bodies
- G. Outlet boxes
- H. Floor boxes
- I. Pull and junction boxes
- J. Surface Metal Raceways
- K. Aluminum conduit

1.2 REFERENCES
- A. NEMA ANSI C80.1 – Electrical Rigid Steel Conduit
- B. NEMA ANSI C80.3 – Steel Electrical Metallic Tubing
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
- D. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports
- E. NFPA 70 - National Electrical Code
- F. NECA "Standard of Installation"
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- H. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel conduit and intermediate metal conduit
- I. NEMA TC 3 – Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

1.3 SUBMITTALS
- A. Submit under provisions of Section 01 33 00.

1.4 PROJECT RECORD DOCUMENTS
- A. Submit under provisions of Section 01 77 00.
- B. Accurately record actual routing of all empty conduits including exterior underground installations and provide written record for the project.
- C. Accurately record actual locations and mounting heights of outlet, pull, and junction boxes.

1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle Products to site under provisions of Section 01 60 00.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.6 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 shown on Drawings is in approximate locations unless dimensioned.
  1. Route as required to complete wiring system.

D. Verify locations of floor boxes and outlets prior to rough-in.
E. Electrical boxes shown on Drawings are in approximate locations unless dimensioned.
   1. Install at location required for box to serve intended purpose.
   2. The Architect may change the location of a box as much as 6', at no extra cost to the Owner.

PART 2 PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Minimum Size: ½" unless otherwise specified, ¾" for home runs and feeders.
B. Underground Installations:
   1. Use rigid galvanized steel conduit (RGS), plastic coated conduit, or thick wall nonmetallic conduit.
   2. Minimum Size is ¾" for home runs and feeders.
   3. Install conduits outside building line at a minimum of 30" below finished grade (except for conduits for Electrical Utility Company's cables.)
   4. Terminate PVC conduits with bell ends or connectors and bushings.
   5. Cover underground PVC conduits larger than 2" outside of building footprint with 3" thick by trench width, 2,500 psi Concrete.
   6. In areas with muck, either de-muck the area or support the conduit from structure or slabs as indicated by the engineer.
   7. Seal underground utility conduits.
   8. All conduit 90 degree bends for conduits larger than 2" shall be rigid galvanized steel conduit.
   9. Install conduits from Electrical Utility Company's connection point to the building service entrance equipment at a min depth of 36" and covered with 3" thick by trench width 2,500-psi concrete.
   10. Underground conduit installation using "directional bore" method shall be allowed with conduits installed at 36" below grade:
      a. Directional bore method not allowed for conduits from Electrical Utility Company's connection point to the building service entrance equipment.
      b. Concrete cover for conduits installed using directional bore, at least 42" below grade, is not required.
      c. Identification tape for conduits installed using directional bore is not required.
C. Outdoor and Wet Locations, Above Grade:
   1. Use rigid steel conduit (RGC).
   2. PVC schedule 80 may extend from underground to maximum of 10'-0" above finished grade on vertical conduit runs only.
   3. The maximum length of liquid-tight flexible nonmetallic or metallic conduit is 6'.
   4. Use EMT minimum 6'-0" above grade
D. In Slab Not on Grade:
   1. Use rigid steel conduit, electrical metallic tubing, and thick wall nonmetallic conduit.
   2. Maximum Size Conduit in Slab is ¾".
E. Outdoor damp Locations:
   1. Use rigid steel conduit, electrical metallic tubing.
   2. PVC schedule 80 may extend from underground to maximum of 10'-0" above finished grade on vertical conduit runs only.
F. Dry Locations: Concealed:
   1. Use rigid steel conduit, electrical metallic tubing.

2. PVC conduit may extend from underground to the first box in interior stud wall, masonry or concrete poured wall.
3. PVC conduit may extend from underground through the slab in tilt wall if it changes to EMT or rigid within 2" above tilt wall.

G. Dry Locations: Exposed:
1. Use rigid steel conduit, electrical metallic tubing.
2. PVC conduit may stub-up under floor-mounted switchgear, floor mounted motor control center, and floor mounted transformer.
3. PVC conduit schedule 80 may extend from underground to maximum of 10'-0" above finished floor on vertical conduit runs only within electrical, communication and mechanical rooms and terminate in approved fittings.
4. PVC conduit may sleeve a grounding electrode conductor or bonding jumper.
5. Installer may use surface metal raceway in remodel or renovation projects only where concealed conduit is not possible or practical.
a. Prior approval required by the Building Department.
b. Use Wiremold 700 series as minimum, or approved equal.

H. Corrosive Areas: PVC externally coated galvanized or thick wall non-metallic conduit.
I. Subject to Physical Damage: PVC externally coated galvanized or rigid steel conduit.
J. Flexible conduit: Minimum ⅜" steel, maximum 6' long for a single fixture from a junction box, for type MC cable, see section 26 05 13.
K. Use steel flexible conduit or liquid tight conduit ½" minimum 6' long maximum, to connect equipment where subject to vibration or frequent changing.

2.2 METAL CONDUIT
A. Rigid Galvanized Steel Conduit: Use material meeting ANSI C80.1.
B. Fittings and Conduit Bodies: Use materials meeting ANSI/NEMA FB 1 material to match conduit and steel fittings.
1. Do not use push-in or snap-in connectors or couplings.

2.3 PVC COATED METAL CONDUIT
A. Description: NEMA RN 1, rigid galvanized steel conduit with external PVC coating, 20-mil thick.
B. Fittings/Conduit Bodies: ANSI/NEMA FB1 steel fittings with external PVC coating to match conduit.
1. Do not use push-in or snap-in connectors or couplings.

2.4 FLEXIBLE METAL CONDUIT
A. Description, interlocked construction
B. Fittings: ANSI/NEMA FB 1, connectors and/or couplings shall be steel or malleable iron.
1. Do not use push-in or snap-in connectors or couplings.

2.5 LIQUID TIGHT FLEXIBLE CONDUIT
A. Description, interlocked construction with PVC jacket
B. Fittings: ANSI/NEMA FB 1, connectors and/or couplings shall be steel or malleable iron.
1. Do not use push-in or snap-in connectors or couplings.
2. Use two-piece fittings.

2.6 ELECTRICAL METALLIC TUBING (EMT)
A. Description: ANSI C80.3 galvanized tubing.
B. Fittings/Conduit Bodies: ANSI/NEMA FB 1 steel compression or setscrew type.
1. Do not use push-in or snap-in connectors or couplings.

2.7 NONMETALLIC CONDUIT
A. Description: NEMA TC 2 Schedule 40 PVC or Schedule 80 PVC.

1. Do not use ENT.

B. Fittings and Conduit Bodies: NEMA TC 3
1. Do not use push-in or snap-in connectors or couplings.

2.8 OUTLET BOXES
A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel, 4" x 4" x 1.5" deep, minimum.
B. Cast Boxes
1. NEMA FB 1 Type FD cast iron.
2. Provide gasketed cover by box manufacturer.
3. Provide threaded hubs.
C. May use PVC single gang boxes on aluminum covered walkway posts where conduit and boxes are covered by aluminum cap on post.

2.9 FLOOR BOXES
A. Floor Boxes: NOT ALLOWED

2.10 PULL AND JUNCTION BOXES
A. Sheet Metal Boxes: NEMA OS 1 galvanized steel.
1. Minimum Size Box is 4" x 4" x 1.5" deep.
B. Surface-Mounted Cast Metal Box, NEMA 250, Type 4; flat-flanged, surface-mounted junction box:
1. Material: Galvanized cast iron
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
C. Fiberglass/Polymer Concrete Hand holes:
1. Use minimum size die-molded fiberglass handholds.
a. Highline Products 111812H series, or approved equal for handholds with conduit sizes 1½" or smaller.
b. Highline Products 132415H series, or approved equal for handholds with conduit sizes 2" or larger.
2. Cover: Bolt down polymer concrete weatherproof cover with ⅜" stainless steel bolts and is traffic rated, color coded for designated system (see section 26 05 53).
D. May use PVC single gang boxes on aluminum covered walkway posts where conduit and boxes are covered by aluminum cap on post.

PART 3 EXECUTION

3.1 INSTALLATION - CONDUIT
A. Install conduit in accordance with NECA "Standard of Installation."
B. Install nonmetallic conduit in accordance with manufacturer's instructions.
C. Arrange supports to prevent misalignment during wiring installation.
D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
E. Support all multiple parallel runs of suspended conduits by steel channel and straps.
F. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.
G. Do not support conduit with perforated pipe straps, and remove any wire used for temporary supports.
H. Steel tie wire may support conduit within interior partitions only.
I. Arrange conduit to maintain a minimum of 6'-6" of headroom and present neat appearance.
J. Route exposed conduit parallel and perpendicular to walls.
1. Exposed conduit below 10' above floor in student areas, shall have a two-hole strap spaced a maximum of 5' oc.

K. Do not route conduits on floors in areas used for access to any equipment.
L. Route the conduit in and under slab from point-to-point.
M. Use liquid tight flexible metal or liquid tight flexible nonmetallic conduit for connection to all motors 3/4 horsepower or larger.
N. Maintain adequate clearance between conduit and piping.
O. Maintain 12" clearance between conduit and surfaces with temperatures exceeding 104°F.
P. Cut conduit square using saw or pipe cutter; de-burr cut ends.
Q. Bring conduit to shoulder of fittings; fasten securely.
R. Join nonmetallic conduit using cement as recommended by manufacturer.
    1. Wipe nonmetallic conduit dry and clean before joining.
    2. Apply full even coat of cement to entire area inserted in fitting.
    3. Allow joint to cure for 20 minutes, minimum.
S. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and cast metal boxes.
T. Use conduit bodies to make sharp changes in direction, as around beams.
    1. Use hydraulic one-shot bender to fabricate factory elbows for bends in metal conduit larger than 1½" size.
U. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
V. Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.
W. Provide a 200-lb. test pull string in each empty conduit except sleeves and nipples.
X. Cap spare and unused conduits by approved means.
Y. Ground and bond the conduit under the provisions of Section 26 05 26.
Z. Identify conduit under provisions of Section 26 05 53.
AA. New Construction: Conceal all conduits run in finished areas.
BB. May install exposed conduits on existing block walls.
    1. Exposed conduits in classrooms, offices, corridors or other normally occupied spaces shall be surface raceways.
CC. Do not install conduits on roof surfaces.
DD. Do not use "all-thread" conduit nipples.
EE. Provide two-1" spare conduits from recessed panel boards and 1” spare conduit from surface panel boards into the closest suspended acoustical ceiling outside the room where panel is located.
FF. Do not use disconnect switches, magnetic starters, contactors, control cabinets, and panel boards as raceways.
GG. Flexible metal conduit and liquid tight flexible metal conduit shall not penetrate walls or ceilings.
HH. Complete electrical raceway installation before starting the installation of conductors.
II. Patch around conduits that penetrate wall, ceiling, or floor.
JJ. Install fire alarm, security, A/C, EMS, ITV, intercom, telephone/data systems, and circuits from different panels in separate raceway systems.
    1. Exception: Installer may install wiring for the sound-field enhancement system and the ceiling projector system above the ceiling without raceway.
        a. Wiring from the wall junction box to the ceiling space must be in conduit.
        b. Sound field enhancement system installation shall meet NEC.
KK. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 07 84 00.

LL. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.
    1. Coordinate location with roofing installation.
MM. If using an existing raceway for new work, it must meet current codes and DMS requirements, or made to meet the requirements.
NN. All locknuts are to be steel or malleable iron.
OO. Aluminum conduit is allowed only in locations where conduit will have direct contact with aluminum walkway covers and aluminum canopies.
PP. Add pull boxes, as necessary, to eliminate conduit runs from exceeding 400' in length for systems and 750’ in length for power.
QQ. Support conduit in or on aluminum walkways with stainless steel bolts or screws.
RR. Caulk the penetrations of walkway roofs with silicone caulking.
SS. May use surface metal raceway in remodel or renovation projects, only where concealed conduit is not possible:
    a. Prior approval required by the Building Department.
    b. Use Wiremold 700 series as minimum, or approved equal.

3.2 INSTALLATION - BOXES

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
B. Install electrical boxes to maintain a 6'-6" headroom and to present neat mechanical appearance.
C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
D. Inaccessible Ceiling Areas: Install junction boxes no more than 24" from ceiling access panel or from removable recessed luminary with box opening facing access panel or luminary.
E. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 07 84 00.
F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
G. Use flush mounting outlet boxes in finished areas.
H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6" separation.
    1. Provide minimum 24" separation in acoustic rated and fire rated walls.
I. Secure flush mounting box to interior wall and partition studs.
    1. Accurately position to allow for surface finish thickness.
J. Use stamped steel bridges or steel studs to fasten flush mounting outlet box between studs.
K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
L. Do not support boxes with wires.
M. Support boxes from building structure or structural member.
N. Use gang box when mounting more than one device together, do not use sectional box.
O. Use gang box with plaster ring for single device outlets.
P. Use cast outlet box in exterior locations exposed to the weather and wet locations.
Q. Use cast iron floor boxes or nonmetallic floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
R. Set floor boxes level.
S. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12" in any dimension.
    1. Interior Dry Locations: Use hinged enclosure under provisions of Section 26 27 16.
    2. Other Locations: Use surface-mounted cast metal box.
T. Do not use floor boxes for feed through wiring except to another floor box.

U. Cast boxes at the end of a run shall have one additional conduit into slab for support.
V. Add pull boxes, as necessary, to eliminate conduit runs from exceeding 400' in length for systems and 750’ in length for power.
W. Locate handholds, in grassy areas.
X. Use a maximum of one extension ring on a box.
Y. Lay-in type ceiling area: Install junction boxes no more than four feet above the ceiling grid.
Z. Use splices in underground locations rated for a wet location.
    1. Hand holes must be set on a minimum of 3” bed of pea-rock.
    2. Label hand holes per 26 05 53.
AA. Fire alarm visual alarm signal devices (strobe lights) shall be set at 80” to 96” to the bottom of the devices’ above finished floor.
BB. If using existing boxes for new work, the box must meet current code and DMS requirements, or made to meet the requirements.

3.3 INTERFACE WITH OTHER PRODUCTS
A. Coordinate installation of outlet box for casework furnished under Section 06 41 00.
B. Coordinate locations and sizes of required access doors with Section 08 31 00.
C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only.
    1. Coordinate masonry cutting to achieve neat opening.
D. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
E. Position outlet boxes to locate luminaries as shown on reflected ceiling plan.

3.4 ADJUSTING
A. Adjust floor box flush with finish flooring material.
B. Adjust flush-mounting boxes to make front flush with finished wall material.
    1. Installer may use plastic Add-a-depth rings for recessed boxes if the box is within ½” of the surface.
C. Install knockout closure in unused box opening.

END OF SECTION