1 Conduits

1.1 All conductors for each and every electrical system shall be installed in a raceway.

1.2 Minimum size of conduits shall be per NEC, and increased as necessary for installation conditions such as bends, insulation, etc. In general use 3/4” minimum, except as follows:

1.2.1 1/2” for runs in 4” masonry walls
1.2.2 1/2” for motor control circuits
1.2.3 1/2” for motor power circuits
1.2.4 1/2” for switch legs to single switches
1.2.5 1/2” for end of run (dead end) devices (one conduit only)

1.3 Separate conduit systems shall be provided for:

1.3.1 Each lighting system
1.3.2 Each lighting control system
1.3.3 Convenience outlets
1.3.4 Each power system by voltage level
1.3.5 Each different system as further defined:
   - Telephone (see Division 27 Communications)
   - Fire Alarm
   - Emergency lighting and EXIT signage
   - Battery lighting
   - Emergency power
   - Audio Visual
   - Control systems
   - Building Automation Control Systems

1.3.6 Except by special permission, separate conduits are required for each feeder, each equipment branch circuit, and for all special systems

1.4 Common conduits will be acceptable for:

1.4.1 Branch circuits originating from the same panel for lighting and outlets
1.4.2 Motor branch circuits, or for a motor circuit and its associated control wiring.

1.4.3 Lighting power and lighting control wiring can be in the same conduit provided the insulation to the control wiring is greater than the highest voltage in the conduit and the manufacturers have stated that it is acceptable to do so.

1.5 All conduits shall be concealed except as follows:

1.5.1 Electrical and mechanical equipment spaces

1.6 All conduits shall bear the Underwriter’s Label.

1.7 All conduits shall be of U.S. manufacture.

1.8 Where GRC or IMC enters a box or other fitting through a knockout, an approved double locknut and bushing shall be provided.

1.9 Conduit bushings shall be threaded type, having insulated inserts equal to O.Z., steel, type “B”. Bushings for feeder conduits shall be grounding type, having lay-in type lug. Threadless bushings may be used in special instances only.

1.10 Six 1” spare conduits up and two 1” spare conduits down shall be installed from each flush mounted light and power panelboard, telephone cabinet, control cabinet and electronic systems cabinets of all descriptions and terminated in space above or at respective ceilings in 4” square boxes with blank covers, two conduits per box. None are required out bottom of panels of slab on grade.

2 Electrical Metallic Tubing (EMT or Thinwall)

2.1 In general 2” is the maximum allowable trade size allowed, unless otherwise noted. This does not apply for audio/visual, telecommunications and special systems

2.2 Feeder conduits 2” and under may be EMT

2.3 EMT will be installed with steel set screw, insulated throat, concrete tight type couplings and connectors as manufactured by Appleton, OZ/Gedney, UL/CSA listed, and meeting Federal Spec #WF408D). Other type fittings will not be acceptable.

3 Rigid Heavy Wall Conduit (Rigid or Intermediate Metal Conduit (IMC))

3.1 Rigid heavy wall conduit shall be installed in the following locations:

3.1.1 Concrete slabs and all poured walls (1” minimum concrete cover, or as required by ACI)

3.1.2 Under slab or underground and encased in 3” minimum concrete, except where located four or more inches below bottom of lowest slab in granular fill
3.1.3 Exposed exterior locations (rigid only)
3.1.4 All exterior masonry constructions
3.1.5 Where exposed to mechanical injury
3.1.6 All explosion proof work (rigid only)
3.1.7 "Vaportight" and "watertight" work
3.1.8 In or above prefabricated concrete decking.

3.2 Rigid heavy wall conduit shall be installed in the following manner:
   3.2.1 Square cut and reamed after cutting threads.
   3.2.2 Installed in accordance with Underwriter’s Laboratories Standard UL6 for Rigid and UL/242 for IMC.
   3.2.3 Installed with double locknuts and bushings except for threaded hubs.
   3.2.4 Used for sleeves except where sheet metal is approved elsewhere.
   3.2.5 Installed with all threaded fittings (the use of set screw or compression type not acceptable)
   3.2.6 Where exiting or entering a concrete slab, extend Rigid or IMC at least 36" before adapting to EMT.
   3.2.7 Where Rigid or IMC enters a junction box or any enclosure within 60" of exiting or entering a concrete slab, the Rigid or IMC shall be continuous into the enclosure.

4 Rigid Non-Metallic Conduit (PVC)
4.1 Conduit shall be heavy wall, rigid, schedule 40, PVC, Carlon "Plus 40" or equal.
4.2 In general for underground site lighting branch circuits only, no concrete encasement is required. Other types of installations may require concrete encasement as indicated on the drawings, other sections of these specifications, as directed by the Owner or by NEC.
4.3 Entire installation shall be watertight.
4.4 Where exiting or entering a concrete slab, PVC shall be adapted to Rigid or IMC at least 12" prior to exiting or entering the slab.
4.5 Utility transformer secondary building entrance; Concrete encased schedule 40 PVC. All underground 90 deg. bends shall be long radius elbows, 24" minimum, at stub-up locations utilize long radius Galvanized Rigid 90 deg. elbows, 24" minimum radius. Galvanized rigid conduit shall be installed from elbow up through slab and groundings bushing installed. Minimum radius of elbows and conduit size shall be increased as necessary depending on length of run and number and configuration of bends/elbows (i.e. distances between bends and/or elbow) to reduce drag and pulling tensions.

4.6 Generator service entrance; Concrete encased schedule 40 PVC. All underground 90 deg. bends shall be long radius elbows, 24" minimum, at stub-up locations utilize long radius Galvanized Rigid 90 deg. elbows, 24" minimum radius. Galvanized rigid conduit shall be installed from elbow up through slab and groundings bushings installed. Minimum radius of elbows and conduit size shall be increased as necessary depending on length of run and number and configuration of bends/elbows (i.e. distances between bends and/or elbow) to reduce drag and pulling tensions.

5 Skeletal Conduit Systems
5.1 Conduits shall be 10 feet lengths of 4” EMT separated 18” to 24” at 10-foot intervals as necessary to clear walls, obstructions, etc.
5.2 Connectors are not required. Bushings however, are required. Use insulated push-on bushings (by Arlington) installed on each end of each conduit section. Ream and smooth cut ends to prevent cable damage.
5.3 Provide two supports for conduit sections on 4 foot spacing.
5.4 Provide sleeves through walls where shown, full size or sized as shown. Patch walls around sleeves per NEC section 300-21. Seal each sleeve with appropriate fire stop.

6 Flexible Metallic Conduits
6.1 “Greenfield” (hot dipped galvanized) is to be used in dry locations only.
6.2 Used for final connections to all recessed fixtures, installed in adequate lengths (6’ maximum) for fixture servicing and convenient removal.
6.3 Flex connectors shall be UL listed for grounding, squeeze type, malleable iron with insulated throat, one or two screw type as O-Z/Gedney, T & B, Raco or approved equal (set screw type, die-cast or screw-in type are not...
acceptable).

6.4 Flexible conduit fittings with external ground connection may be required under special circumstances as shown on Drawings, listed in Job Scope or as directed by the Owner’s Representative.

7 Flexible Liquid-Tight Metallic Conduit "Sealtite" or “Carflex” Flexible Non-Metallic Conduit

7.1 To be used in damp or wet locations, including exterior, water softener, brine handling and equipment located within air chamber of air handling equipment, with NEC grounding.

7.2 To be used for final connections to all motors, 3 ft. maximum length, unless otherwise approved.

7.3 Liquid tight fittings shall be UL listed for grounding, ferrule and sleeve type with insulated throat as O-Z/Gedney “4Q” series, T & B, Appleton “ST” or Carlon “Carflex fitting for Carflex or approved equal.

7.4 Minimum allowable size is ½" unless otherwise noted, 3/8” permissible for fixture whips.

7.5 Supported within 3 ft. of motor terminals and 6 ft. of lighting fixtures.

8 Fittings

8.1 Conduit Bodies:

8.1.1 "LBD” and Mogul size for 1” and larger conduits.

8.1.2 Cast ferrous material for exterior, watertight and vapor tight locations with gaskets at covers.

8.1.3 As manufactured by Appleton, Pyle National or Crouse Hinds or Killark.

8.2 Expansion Fittings

8.2.1 Installed in each run of conduit that crosses a building expansion joint, outside or within structural slabs.

8.2.2 Provided with bonding straps.

8.2.3 As manufactured by O.Z. or approved equal.

8.3 Conduit Seals (Vapor and Water)

8.3.1 Installed in each run of conduit between different temperature zones likely to cause condensation and circulation of moisture.

8.3.2 Installed in each run of conduit between a hazardous location and a non-hazardous (per NEC) location likely to cause the spread of vapors, dust, etc.

8.3.3 Filled with proper sealing compound in accessible locations.

8.3.4 Installed in walls where conduits enter/leave below grade. OZ/Gedney Type “FSK”, Link Seal “LS” series or equal.

8.4 Conduit Hubs

8.4.1 Conduit hubs shall be installed for all GRC or IMC terminations to sheet metal type enclosures for installations requiring a watertight or dust tight seal.

8.4.2 Hubs shall have insulated throat and recessed O-Ring seal.

8.4.3 Hubs shall be as O-Z/Gedney, T & B, Myers or approved equal

9 Conduits Penetrating Roof:

9.1 One conduit per sleeve

9.2 Minimum height of sleeve not less than 12” above roof membrane

9.3 Provided rain shield on conduit overlapping sleeve a minimum of 2 inches

9.4 Secure rain shield to conduit with stainless steel pressure clamps

9.5 Provide flashing as required

10 Outlet Boxes

10.1 General

10.1.1 Every switch, light, wall receptacle, signal device, telephone outlet, etc., shall be provided with an outlet box.

10.1.2 "Through wall" and "Handy boxes" are not acceptable

10.1.3 Boxes installed “Back to Back” or within 12” center to center, penetrating opposite sides of wall construction, and installed in a fire resistive and/or fire rated wall shall not be permitted.

10.2 Sizing

10.2.1 All boxes shall be sized in accordance with NEC.

10.2.2 Four inch square x 2 1/8” deep for 2 or more conduits or devices
10.2.3 Four inch octagon or square boxes are to be used for fixture outlets.

10.2.4 Three inch x two inch (3"x2") conduit switch box 2½" deep for single conduit (dead-end), Raco #503 in drywall and Raco #690 in masonry or approved equal.

10.3 Approved Manufacturers

10.3.1 Appleton

10.3.2 Steel City

10.3.3 Raco

10.4 Refer to ITaP Division 27 Communications, Division 28 Electronic Safety and Security Fire Detection and Alarm and Purdue AV Services for other outlet/device and specialty boxes.

11 Surface Raceways

11.1 Metal Raceways

11.1.1 All surface metal raceways and fittings shall be as manufactured by the Wiremold Co., West Hartford, CT, and Hubbell or approved equal. Factory finished color shall be ivory.

11.1.2 One Piece Surface Metal Raceways:

11.1.2.1 Wiremold #500 or #700 Series and fittings or Hubbell equal

11.1.3 Two Piece Surface Metal Raceways:

11.1.3.1 Wiremold #2100 Series or Hubbell equal

11.1.3.2 Wiremold #3000, #4000, #6000 Series or Hubbell equal

- #3000 = 2-3/4" W x 1-7/32" D
- #4000 = 4-3/4" W x 1-3/4" D
- #6000 = 4-3/4" W x 3-9/16" D

11.1.4 Where two-piece raceway covers pass through walls, floors, and/or ceilings, the cover shall be cut on both sides of the wall, floor or ceiling (maximum of 6" from edge of penetration) to permit removal of the cover on each side of the obstruction.

11.1.5 To maintain electrical continuity where two-piece surface raceway is fed from a flush mounted/recessed device box, use the appropriate manufactures connector fitting. If manufactures fitting is not available the back of raceway is to be cut out to the size of the device box opening and raceway attached to device box using appropriate size machine screws. The use of chase nipple is not acceptable.

11.2 Non-Metal Raceways

11.2.1 All surface non-metallic raceways and fittings shall be as manufactured by the Panduit Co. or Hubbell.

11.2.2 One Piece Non-Metallic Surface Raceway:

11.2.3 Panduit Type L

11.2.4 Two Piece Surface Non-Metallic Raceways

11.2.4.1 Panduit Type “T” Series

11.2.4.2 Hubbell “Basetrak”, series

11.2.5 Where two-piece raceway covers pass through walls, floors, and/or ceilings, the cover shall be cut on both sides of the wall, floor or ceiling (maximum of 6" from edge of penetration) to permit removal of the cover on each side of the obstruction.

11.3 Troughs

11.3.1 All troughs and fittings shall be as manufactured by Square D, Hoffman or approved equal.
## 12 Table of Mounting Heights

<table>
<thead>
<tr>
<th>Device</th>
<th>Reference</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switches</td>
<td>floor - top</td>
<td>+ 4'-0&quot;</td>
</tr>
<tr>
<td>Outlets</td>
<td>floor – bottom</td>
<td>+ 1'-6&quot;</td>
</tr>
<tr>
<td>Plugstrip</td>
<td>floor – top</td>
<td>+ 4'-0&quot;</td>
</tr>
<tr>
<td>Dimmer</td>
<td>floor – top</td>
<td>+ 4'-0&quot;</td>
</tr>
<tr>
<td>Wall Speaker</td>
<td>ceiling - top</td>
<td>+/- 1'-0&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(verify)</td>
</tr>
<tr>
<td>Telephone Outlet</td>
<td>floor – bottom</td>
<td>+ 1'-6&quot;</td>
</tr>
<tr>
<td>Wall Phone</td>
<td>floor - bottom</td>
<td>+ 4'-0&quot;</td>
</tr>
<tr>
<td>Wall Phones - Handicapped</td>
<td>floor - center</td>
<td>+ 3'-4&quot;</td>
</tr>
<tr>
<td>Fire Alarm Station</td>
<td>floor - top</td>
<td>+ 4'-0&quot;</td>
</tr>
<tr>
<td>Safety Switch</td>
<td>floor - top</td>
<td>+ 6'-0&quot;</td>
</tr>
<tr>
<td>Motor Starter</td>
<td>floor - top</td>
<td>+ 6'-0&quot;</td>
</tr>
<tr>
<td>Relay Panel</td>
<td>floor - top</td>
<td>+ 6'-0&quot;</td>
</tr>
<tr>
<td>Branch Circuit Panel</td>
<td>floor - top</td>
<td>+ 6'-0&quot;</td>
</tr>
<tr>
<td>Push Button</td>
<td>floor - bottom</td>
<td>+ 4'-0&quot;</td>
</tr>
<tr>
<td>Control Station</td>
<td>floor - bottom</td>
<td>+ 4'-0&quot;</td>
</tr>
<tr>
<td>Microphone Outlet</td>
<td>floor - bottom</td>
<td>+ 1'-6&quot;</td>
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<tr>
<td>Clock</td>
<td>ceiling - top</td>
<td>+/- 1'-0&quot;</td>
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<td>Bells</td>
<td>ceiling - top</td>
<td>+/- 1'-0&quot;</td>
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</tr>
<tr>
<td>Control Station for Electric Operated Doors</td>
<td>floor - center</td>
<td>+ 3'-0&quot;</td>
</tr>
</tbody>
</table>

**Note:** All references are from finished floor or ceiling to the device box.