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Raceway and Boxes for Electrical Systems

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A. Conduits:

1. All conductors for each and every electrical system shall be installed in a raceway except communications and A/V systems which shall have stubs to open ceilings and open cable.
2. Minimum size of conduits shall be per NEC, and increased as necessary for installation conditions such as bends, insulation, etc. Use 3/4" minimum. Some consultant's boilerplate specs allow for 1/2" on switchlegs and temperature controls. We don't allow that. Use 3/4" minimum. No exceptions.
3. Separate conduit systems shall be provided for:
 - a. Each lighting system
 - b. Convenience outlets
 - c. Each power system by voltage level
 - d. Each different system as further defined:
 01. Communications (voice and data)
 02. Fire Alarm
 03. Emergency lighting and EXIT signage
 04. Emergency power
 05. Control systems
 06. Building Automation Control Systems
 - e. Except by special permission, separate conduits are required for each feeder, each equipment branch circuit, and for all special systems
4. Common conduits will be acceptable for:
 - a. Branch circuits originating from the same panel for lighting and outlets
 - b. Motor branch circuits, or for a motor circuit and its associated control wiring.
 - c. 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
5. All conduits shall be concealed except as follows:
 - a. Electrical and mechanical equipment spaces
6. All conduits shall bear the Underwriter's Label.
7. All conduits shall be of U.S. manufacture.
8. Where GRC or IMC enters a box or other fitting through a knockout, an approved double locknut and bushing shall be provided.
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,



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10. Six 1" spare conduits up and two 1" spare conduits down shall be installed from each flush mounted light and power panelboard 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.
- B. Electrical Metallic Tubing (EMT or Thinwall)
 1. Feeder conduits may be EMT.
 2. EMT will be installed with steel compression or set screw, insulated throat, concrete tight type couplings and connectors. Other type fittings will not be acceptable.
- C. Rigid Heavy Wall Conduit (Rigid or Intermediate Metal Conduit (IMC)) :
 1. Rigid heavy wall conduit shall be installed in the following locations:
 - a. All poured walls (1" minimum concrete cover)
 - b. 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
 - c. Exposed exterior locations (rigid only)
 - d. All exterior masonry constructions
 - e. Where exposed to severe mechanical injury(rare, e.g. loading dock area where fork trucks are in use.)
 - f. All explosion proof work (rigid only)
 - g. "Vaportight" and "watertight" work
 - h. Do not install within floor slabs or slabs on grade. Many boilerplate specs allow this. We don't. We have had issues with workers receiving electric shock from coring or cutting into slabs with embedded conduits. It is also difficult to re-route circuits that get interrupted from coring or cutting.
 2. Rigid heavy wall conduit shall be installed in the following manner:
 - a. Square cut and reamed after cutting threads.
 - b. Coupled with Erickson Couplings in lieu of running threads, if necessary.
 - c. Installed with joints sealed with conductive, waterproof conduit joint compound (where underground or in concrete walls), equal to T & B "KOPR-SHIELD" or Sherwin Williams "ZINC-CLAD".
 - d. Installed in accordance with Underwriter's Laboratories Standard UL6 for Rigid and UL/242 for IMC.
 - e. Installed with double locknuts and bushings except for threaded hubs.
 - f. Used for sleeves.
 - g. Installed with all threaded fittings (the use of set screw or compression type not acceptable)
 - h. Where exiting or entering a concrete slab, extend Rigid or IMC at least 12" before adapting to EMT.
 - i. Where Rigid or IMC enters a junction box or any enclosure within 60" of exiting or entering a



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concrete slab, the Rigid or IMC shall be continuous into the enclosure.

D. Rigid Non-Metallic Conduit (PVC):

1. Conduit shall be heavy wall, rigid, schedule 40, PVC, Carlon "Plus 40" or equal and may be installed under floor slabs for branch circuits or feeders.
2. In general for underground site lighting branch circuits only, no concrete encasement is required. Other types of installations may require concrete encasement as directed by the Owner or by NEC.
3. Entire installation shall be watertight.
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.
5. 5" or 6" schedule 40 encased in concrete for ductbanks. Coordinate with BSU for further instruction and for BSU standard ductbank details.

E. Skeletal Conduit Systems:

1. Conduits shall be 10 foot lengths of 4" EMT separated 18" - 24" at 10-foot intervals as necessary to clear walls, obstructions, etc.
2. Connectors or bushings are not required. Ream and smooth cut ends to prevent cable damage.
3. Provide two supports for conduit sections on 6 foot spacing.
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.

F. Flexible Metallic Conduits:

1. "Greenfield" (hot dipped galvanized) is to be used in dry locations only.
2. Used for final connections to all recessed fixtures. Installed in adequate lengths (6' maximum) for fixture servicing and convenient removal.
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).
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.

G. Flexible Liquid-Tight Metallic Conduit "Sealtite"

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.
2. To be used for final connections to all motors, 3 ft. maximum length, unless otherwise approved.
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 approved equal.
4. 1/2" minimum allowable size.
5. Supported within 3 ft. of motor terminals.



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H. Fittings:

1. Conduit Bodies:

- a. "LBD" and Mogul size for 1" and larger conduits.
- b. Cast ferrous material for exterior, watertight and vapor tight locations with gaskets at covers.
- c. As manufactured by Appleton, Pyle National or Crouse Hinds or Killark.

2. Expansion Fittings:

- a. Installed in each run of conduit that crosses a building expansion joint.
- b. Provided with bonding straps.
- c. As manufactured by O.Z. or approved equal.

3. Conduit Seals (Vapor and Water):

- a. Installed in each run of conduit between different temperature zones likely to cause condensation and circulation of moisture.
- b. 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.
- c. Filled with proper sealing compound in accessible locations.
- d. Installed in walls where conduits enter/leave below grade. OZ/Gedney Type "FSK", Link Seal "LS" series or equal.

4. Conduit Hubs:

- a. 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.
- b. Hubs shall have insulated throat and recessed O-Ring seal.
- c. Hubs shall be as O-Z/Gedney, T & B, Myers or approved equal

I. Conduits Penetrating Roof:

1. One conduit per sleeve
2. Minimum height of sleeve not less than 12" above roof membrane
3. Provided rain shield on conduit overlapping sleeve a minimum of 2 inches
4. Secure rain shield to conduit with stainless steel pressure clamps
5. Provide flashing as required

J. Outlet Boxes

1. General:

- a. Every switch, light, wall receptacle, signal device, telephone outlet, etc., shall be provided with an outlet box.
- b. "Through wall" and "Handy boxes" are not acceptable
- c. Boxes installed "Back to Back" or within 12" center to center, penetrating opposite sides of



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- wall construction, and installed in a fire resistive and/or fire rated wall shall not be permitted.
- d. Outlet boxes installed in stud walls shall be supported across both studs with hanger such as Erico Caddy RBS or SGB series. Hangers that support from only one stud such as Erico Caddy HS3 are not allowed.
2. Sizing:
 - a. All boxes shall be sized in accordance with NEC.
 - b. Four inch square x 2 1/8" deep for 2 or more conduits or devices with appropriate device rings.
 - c. Four inch octagon or square boxes for fixture outlets.
 - d. Communications outlets shall typically be deep 4 square boxes with single gang extension rings and 1" EMT stubbed out to corridor skeletal system gaps. Conduit stubs shall be de-burred only. Do not terminate with bushings.
 - e. Utilize extra (3 1/2") deep four inch square boxes with appropriate device rings in electronic classrooms where shown on BSU standard electronic classroom rough-in details. Conduit stubs for these boxes may need to be up to 2". Coordinate with BSU.
 3. Approved Manufacturers:
 - a. Appleton
 - b. Steel City
 - c. Raco
- K. Surface Raceways
1. Metal Raceways. Use only with Owner's permission and specifically shown on the drawings:
 - a. 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 selected by BSU during design,
 - b. One Piece Surface Metal Raceways:
 01. Wiremold #500 or #700 Series and fittings or Hubbell equal
 - c. Two Piece Surface Metal Raceways:
 01. Wiremold #2100 Series or Hubbell equal
 02. Wiremold #3000, #DS4000, #6000 Series or Hubbell equal
 2. #3000 = 2-3/4" W x 1-7/32" D
 3. #DS4000 Designer Series or #4000 series. Confirm with BSU which to use in a given application.
 4. #6000 = 4-3/4" W x 3-9/16" D
 - a. 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.
 5. Non-Metal Raceways. Use only with Owner's permission and specifically shown on the drawings:
 - a. All surface non-metallic raceways and fittings shall be as manufactured by the Panduit Co. or



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- Hubbell.
- b. One Piece Non-Metallic Surface Raceway:
 - 01. Panduit Type L
 - c. Two Piece Surface Non-Metallic Raceways:
 - 01. Panduit Type "T" Series
 - 02. Hubbell "Basetrak", series
 - d. 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.
6. Troughs:
- a. All troughs and fittings shall be as manufactured by Square D, Hoffman or approved equal.

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L. Mounting Heights

Table 1

MOUNTING HEIGHT SCHEDULE		
Device	Reference	Height
Switches	floor - center	+ 4'-0"
Outlets	floor – center	+ 1'-6"
Plugstrip	floor – center	+ 4'-0"
Dimmer	floor – center	+ 4'-0"
Wall Speaker	ceiling - top	+/- 1'-0" (verify)
Telephone Outlet	floor – center	+ 1'-6"
Wall Phone	floor - center	+ 4'-0"
Wall Phones - Handicapped	floor - center	+ 3'-4"
Fire Alarm Station	floor - center	+ 4'-0"
Safety Switch	floor - top	+ 6'-0"
Motor Starter	floor - top	+ 6'-0"
Relay Panel	floor - top	+ 6'-0"
Branch Circuit Panel	floor - top	+ 6'-0"
Push Button	floor - center	+ 4'-0"
Control Station	floor - center	+ 4'-0"
Microphone Outlet	floor - bottom	+ 1'-6"
Clock	ceiling - top	+/- 1'-0" (verify)
Bells	ceiling - top	+/- 1'-0" (verify)
Control Station for Electric Operated Doors	floor - center	+ 3'-0"

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