PART 1  GENERAL

1.01  Definitions:

A. For the purposes of this article, a “home run” is the raceway and conductors from the breaker panel to the first distribution box.

B. For the purposes of this article, the “first distribution box” is the junction or outlet box in a work area or room from which circuit(s) may be distributed to one or more outlets or devices. The box may contain a plug, switch, or similar device.

1.02  As-built Drawings: Box locations to be accurate to +/- 2 feet.

PART 2  PRODUCTS

2.01  Electrical Metallic Tubing (EMT):

A. Steel compression connectors with insulated throats or bushings.

B. Steel compression couplings.

C. Rain or concrete tight compression fittings.

   1. In poured-concrete walls and floors.

   2. In locations subject to moisture.

D. Acceptable for feeders when inside building and not subject to physical damage.

E. Not allowed:

   1. Set-screw fittings

   2. Cast fittings

2.02  Rigid Metal or Intermediate Metal Conduit: Threaded hubs and connections with insulated throats only.

2.03  Flexible Metal Conduit:

A. Steel or malleable iron fittings with insulated throat.

B. Die-cast zinc or threaded inside throat fittings are not acceptable.

C. Screw-in connectors and couplings are not acceptable (Example: Steel City XC846).

2.04  Liquidtight Flexible Metal Conduit: steel or malleable iron fittings with insulated throat.
2.05 Metal Clad Cable, Type MC:

A. 480/277 Volt systems: Fixture whips only.

B. 208/120 Volt Systems:
   1. Allowed for 120V, 20 A or 15A convenience outlets.
   2. Shall not to be used to supply light switches.

C. Shall not be used for home runs or for runs between rooms. Intent is for conduit to distribution box in an area (room) then use MC cable from box to final utilization outlet box/equipment.

2.06 Cor-line brand fittings or equal acceptable for in-slab applications.

2.07 Outlet Boxes:

A. Minimum size: 4 inch square or octagonal, 2½ inch deep unless otherwise noted.

B. Provide 2½ inch deep boxes when supporting lights and equipment, rated for the weight of the expected equipment.

C. Provide 2½ inch deep boxes when mounted in concrete or masonry.

D. Provide 2½ inch deep boxes or larger for all telecommunications wiring.

E. Provide cast aluminum or iron (galvanized) boxes for exterior or wet locations.

F. Not allowed to penetrate building vapor retarder without written approval of FS/DDC. Where sheet metal boxes are allowed to penetrate vapor retarder, their exterior surfaces shall be sealed and edges of vapor retarder shall be securely sealed to the face of the box. Raceways entering/leaving boxes shall be sealed per requirements stated elsewhere.

2.08 Surface Metal Raceway:

A. Components:
   1. Mono-systems SnapMark SMS3200 or SMS 4200 series.
   2. Wiremold 700, 3000, 4000, 6000 series.
   3. Hubbell, HBL3000, HBL4750.
   4. No Substitutions
B. Use Prefinished Surface Metal Raceway in colors that are available from the manufacturer.

C. All parts of Surface Metal Raceway installation, including receptacle cover plates, to be of the same manufacturer as the multi-outlet assembly or manufacturer's recommendations.

D. Provide Surface Metal Raceway manufacturer’s transition fittings and boxes between Surface Metal Raceway and conduit and/or junction boxes.

2.09 Fire-stopping: Where cables, including communication cables, are not in conduit and penetrate fire rated walls use manufactured, non-removable fire-stopping equipment. Consideration will be given to control of air flow when using these devices. Examples: EZ-Path System or Hilti Speed Sleeve.

2.10 In ground junction/pull boxes:

A. Have a safety factor of 2.

B. In areas away from vehicle traffic such as dirt, grass, landscaping: ANSI Tier 15.

C. In or near driving lanes, sidewalks, parking lots, and areas of similar usage: ANSI Tier 22.

D. Metal covers shall be bonded to the grounding system with a stranded grounding conductor secured with a grounding lug and of sufficient length to allow cover to be entirely removed from the box opening.

PART 3 EXECUTION

3.01 Abandoned raceways:

A. Confirm with FS/DDC raceways to be abandoned.

B. Meet applicable requirements for “Unused Raceways”.

3.02 Unused raceways:

A. Label unused raceways left in place as to access points and terminations, and show on the as-built drawings. Provide dimensions to access points and terminations from a known building feature such as wall lines, column lines, etc.

B. Provide "pull strings" in installed empty raceways for future conductor installation.

C. Cap and stake empty raceways terminating exterior of the building and underground. Mark on the as-built drawings location based off building corners. Seal to prevent moisture migration as specified elsewhere.
3.03 Flush-mounted panelboards:
   A. Discuss quantity of spare raceways stubbed into accessible ceiling space to maximize future utilization all spare breakers and spaces based on types of loads/spaces served and ease of access into panel. Minimum size: ¾ inch.
   B. At a minimum provide three (3) spare 3/4 inch and one (1) 1 inch raceways stubbed into an accessible ceiling space and capped in the panel.

3.04 Minimum size home runs for lighting and receptacle circuits: ¾ inch.

3.05 Dust infiltration: In areas prone to high levels of dust (i.e. wood shop, soils lab, etc.):
   A. Seal raceway entering room inside of the room at the nearest feasible point where joints in the raceway between the seal and the room penetration do not defeat the purpose of the seal.
   B. Utilize weathertight boxes and covers.
   C. Utilize liquid tight flexible raceway where flexible raceway required.
   D. Utilize dust-tight fixtures and equipment.
   E. Seal raceways entering fixtures.

3.06 Air, moisture, and water infiltration:
   A. Where raceways penetrate building envelopes:
      1. Flex shall not be used to penetrate vapor retarder, air barrier, or moisture barrier.
      2. Provide solid blocking installed flat at all vapor retarder penetrations. On the interior face of the exterior stud wall, flat blocking installed at each penetration shall be a minimum of four (4) inches larger than the penetration. Locate the penetration at the centerline of the flat blocking. Secure vapor retarder to blocking.
      3. Seal the interior of the raceway inside of the building. Between point of sealing inside of raceway, normally at junction box or conduit, and vapor retarder penetration, seal joints (connectors and couplings) of raceway with vapor retarding tape, paint-on sealer or other means acceptable to owner.
      4. To reduce thermal transfer and ensure sealing of raceway, PVC with glued joints, or equivalent, is the preferred raceway where penetrations of building envelope are made above ground.
B. Where raceways travel from one floor of a building to another, or between areas maintained at unequal pressure and/or humidity, seal the raceways to prevent airflow and/or humidity migration due to air/vapor pressure differential.

C. Flex shall not be used to connect raceways in contiguous areas having differing environmental requirements such as humidity, pressure, temperature, or cleanliness.

D. Where a raceway passes into or through an air intake duct, refrigerator, etc., install in such a manner to prevent the buildup of moisture or ice which would cause damage to the raceway or its contents.

E. Where raceways penetrate the building envelope close to grade, landscape to prevent standing water from reaching the penetration in building envelope.

F. Design raceways penetrating building so water will not enter the building through the raceway or through the penetration in the building wall or foundation. Raceway entering a building below grade shall be designed so that water in raceway will not flow into electrical equipment.

G. Design raceways to encourage the drainage of water from inside the raceway. Conduit penetrating into electrical equipment shall be sloped to not allow water to flow into the equipment or be so configured to drain raceway before it enters electrical equipment.

H. Conduit bodies shall not be buried or covered with soil.

I. Seal feeder raceways at both ends where feeder runs between building floors or penetrates the building envelope.

J. Seal raceways into/out of laboratory/research areas requiring special environments, such as animal quarters, walk-in environmental chambers, clean rooms, walk-in freezers or chillers, and BSL-3 labs.

K. Use mechanical or expanding foam sealant in and around raceways penetrating building below grade to provide watertight seal.

L. If the area within 6 feet of any sprinkler valve or fitting is considered a wet location, use weatherproof boxes.

3.07 On roofs:

A. Horizontal runs on roof surfaces: Intermediate metal conduit (IMC) or rigid metal conduit (RMC) except where elevated 3 feet above roof surface or protected from damage.

B. Secure horizontal runs of ½ inch conduit at least every 8 feet.
C. At transitions from horizontal to vertical or seismic break:
   1. Secure conduits within 3 feet of the transition.
   2. Provide flexible transition to allow for movement.

D. Provide drainage at low points of conduit runs.

3.08 Transitions between different types of raceway:

A. Rigid conduit to flexible conduit: Use a manufactured one piece fitting for transitioning from rigid conduits, such as EMT, rigid steel conduit, and IMC, to a flexible conduit when it is available. When such a one-piece transition fitting is not available, a field fabricated transition of connector / rigid coupling / connector will be acceptable. Example of one-piece transition fittings: O-Z/DEDNEY Transition Couplings for Rigid Metal Conduit and IMC to Flexible Metal Conduit Type CB.

B. Rigid conduit to rigid conduit: Use a one-piece manufactured fitting. Example of one piece transition fittings: O-Z/DEDNEY Transition Couplings for Rigid Metal Conduit and IMC to EMT Type ETR.

C. Use manufactured transition fitting between conduit and recessed boxes and Surface Metal Raceway.

D. Use a junction box to transition from MC cable to conduit.

3.09 Do not route raceways on the floor unless specifically instructed by FS/DDC.

3.10 Provide low-voltage cable systems with a continuous pathway. Where multiple low-voltage systems are run along the same pathway, provide separate cable support/management for each system: J-hooks, conduits, or cable tray with dividers. Short discontinuous sections of conduit are not acceptable substitutes for J-hooks.

3.11 Install conduit bodies to make sharp changes in direction. “Goosenecks” are not acceptable.

3.12 Bushings:
   A. Metal bushing on raceways 2 inch and larger.
   B. Grounding bushings on feeders and raceways containing circuits 60A or larger.

3.13 Not more than one box extension ring is allowed.

3.14 Flexible Metal Conduit and Liquidtight Flexible Metal Conduit:
   A. Install so as to prevent chafing or other damage to itself or other equipment.
B. Install so as to not interfere with access to surrounding equipment.

C. Provide slack connections to motors, vibrating equipment, or equipment that requires removal for maintenance:
   1. Maximum length: 6 feet.

3.15 Right of way: Give to ductwork and piping systems installed at a required slope.

3.16 Install raceways so as to not impede removal of, or access to, equipment, such as motors, fans, access panels, and control enclosures.

3.17 Surface Metal Raceway:
   A. Data/communications ports and power outlets as close as practicable. Maximum separation: 20 inches.
   B. Raceway bases, covers, device fittings, plates and accessories shall be installed flush, tight and square.
   C. Gaps between raceway segments, accessories, device plates, and cover joints shall not exceed 1/16 inch.
   D. Protect raceway during and after installation. Raceway with scratches, deformities, or from different color lots will be rejected.
   E. Bond each section together to provide electrically continuous system. Refer to “Grounding and Bonding of Electrical Systems”.
   F. All parts of the raceway shall be of the same manufacturer, style, and type.

3.18 Separation of raceways from other systems:
   A. Separation from heating system pipes, flues, other high temperature piping systems, and other heat sources:
      1. Minimum 6 inch from parallel runs of heating system pipes, flues, other high temperature piping systems, and other heat sources.
      2. Minimum spacing shall be increased if necessary to ensure that raceways experience no significant temperature rise from external sources.
      3. Raceways shall not be embedded in any spray applied insulation, fireproofing, or other materials that would restrict heat dissipation.
   B. Piping containing liquids: 6 inches
   C. Air ducts: 6 inches
D. Where conditions do not allow the separations stated above:

1. Minimum 3 inches separation from copper piping, or other dissimilar metal.

2. Minimum ½ inch separation from other systems.

3.19 For outlet boxes flush-mounted in sound rated or acoustically insulated walls: sealant pads are to extend to meet covering wall surface, or cover gaps around mud ring with pads and seal between gypsum board and box with acoustical sealant. Intent is to seal sound transmission from gaps in mud ring or gaps between box surface and covering wall surface.

3.20 Mount outlets and boxes to be accessible after construction is complete by coordinating with other crafts.

3.21 Boxes and electrical equipment shall be installed securely fastened to the structural framing of the surrounding construction. Anchoring to sheetrock is not acceptable.

3.22 Metal bushings: for power conduits 2 ½ inch and above.

END OF SECTION