

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Sections

1. Section 26 05 29 - Hangers and Supports for Electrical Systems
2. Section 26 05 33.10 - Flush Floor Outlets
3. Section 27 10 00 - Communication Systems Infrastructure

1.2 SUMMARY

- A. Section includes raceways, fittings, boxes, enclosures and cabinets for electrical wiring.
- B. Substitutions: Substitute products will be considered only under the terms and conditions of Section 26 05 00 - Common Work Results For Electrical.

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
- B. National Electrical Manufacturers Association (NEMA)
- C. Underwriters Laboratories, Inc. (UL)
- D. National Fire Protection Association (NFPA)

1.4 SUBMITTALS

- A. Make submittals in accordance with Section 26 05 00 - Common Work Results For Electrical. Submit product data only for surface raceways and fittings, wireways, enclosures and cabinets.

1.5 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT (RMC)

- A. Rigid Steel Conduit: ANSI C80.1, UL 6.
- B. Intermediate Metal Conduit: ANSI C80.6, UL 1242.
- C. Fittings: NEMA FB1, UL 514B, galvanized malleable iron or non-corrosive alloy threaded fittings. Erickson and watertight split couplings are permitted. Set screw and running thread fittings are not permitted.

- D. Conduit Bodies and Fittings Manufacturers: American Electric; Construction Materials Group, Crouse-Hinds; Div. of Cooper Industries, Emerson Electric Co.; Appleton Electric Co., Hubbell, Inc.; Killark Electric Manufacturing Co., Lamson & Sessions; Carlon Electrical Products, O-Z/Gedney; Unit of General Signal, Scott Fetzer Co.; Adalet-PLM, Spring City Electrical Manufacturing Co., Link Seal, Thomas & Betts.
- E. Plastic Coated Rigid Steel Intermediate Metal Conduit: NEMA RN1.

2.2 ELECTRIC METALLIC TUBING (EMT)

- A. Hot dip galvanized, electrogalvanized or sherardized, steel tubing, ANSI C80.3, UL 797.
- B. Fittings: NEMA FB1 UL 514B, steel, compression or set screw. Indentor, drive-on, die cast or pressure cast fittings not permitted. For conduits serving power and lighting circuits below 2" trade size, steel compression fittings only.
- C. Conduit Bodies and Fittings Manufacturers: American Electric; Bridgeport, Construction Materials Group, Crouse-Hinds; Div. of Cooper Industries, Emerson Electric Co.; Appleton Electric Co., Hubbell, Inc.; Killark Electric Manufacturing Co., Lamson & Sessions; Carlon Electrical Products, O-Z/Gedney; Unit of General Signal, Scott Fetzer Co.; Adalet-PLM, Spring City Electrical Manufacturing Co., Link Seal, Thomas & Betts.

2.3 FLEXIBLE METAL CONDUIT (FMC)

- A. UL 1, galvanized, or zinc coated flexible steel or aluminum for dry locations. Flexible metallic tubing not permitted. Fittings: malleable iron or steel.
- B. Liquidtight Flexible Metal Conduit. UL 360, PVC weatherproof cover over flexible steel conduit. Fittings: galvanized or zinc coated.

2.4 SURFACE RACEWAY

- A. Surface Metal Raceway: Galvanized steel with snap on covers. Manufacturer's standard ivory or buff painted finish. UL 5.
- B. Surface Nonmetallic Raceway: 2-piece construction manufactured of rigid PVC compound with matte texture and manufacturer's standard ivory color. UL 5A.
- C. Types, sizes, and channels as indicated on drawings and required for each application with fittings that match and mate with raceways.
- D. Manufacturers: Subject to compliance with the requirements, manufacturers offering products that may be incorporated into the work include:
 - 1. Surface Metal Raceways: Airey-Thompson Co., Inc.; A-T Power Systems, American Electric; Construction Materials Group, Butler Manufacturing Co.; Walker Division, Wiremold Co. (The); Electrical Sales Division, Mono Systems, Hubbell Wiring Systems Inc.

2.5 RIGID NON-METALLIC CONDUIT (RNC)

- A. Schedule 40 and 80: UL 651.

- B. Type EB and B: UL 651, NEMA TC6.
 - C. Fittings: NEMA TC3.
- 2.6 LIQUIDTIGHT FLEXIBLE NON-METALLIC CONDUIT (LFNC)
- A. UL 1660
- 2.7 EXPANSION FITTINGS
- A. Malleable iron, hot dip galvanized allowing 4" (100mm) (+/- 2" (50mm)) conduit movement. OZ/Gedney AX Series or equivalent by manufacturer listed in 2.1.D.
- 2.8 RACEWAY PENETRATION SEALS
- A. Thruwall and Floor Seals: New construction - OZ/Gedney FSK Series. Existing construction - OZ/Gedney CSM Series or equivalent by manufacturer lists in 2.1.D.
- 2.9 RACEWAY SEALING FITTINGS
- A. For one through four conductors: OZ/Gedney CSB Series.
 - B. For greater than four conductors: OZ/Gedney EYA Series with sealing compound.
 - C. Low temperature or hazardous locations: OZ/Gedney EYA Series with sealing compound.
- 2.10 VERTICAL CABLE SUPPORTS
- A. Factory-fabricated assembly consisting o threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables. Body shall be malleable iron.
 - 1. OZ/Gedney Type S or equivalent by manufacturer listed in 2.1.D.
- 2.11 METAL WIREWAYS
- A. Material: Sheet metal, size and shape as indicated. Manufacturer's standard finish. UL 870.
 - B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 - C. Manufacturer: Subject to compliance with the requirements, manufacturers offering products that may be incorporated into the work include: Hoffman Engineering Co., Keystone/Rees, Inc., Square D Co., Circle AW, B-Line.
 - D. Wireway Covers: Screw-cover type except hinged type where noted on the drawings.

2.12 ENCLOSURES AND CABINETS

- A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

2.13 OUTLET JUNCTION AND PULL BOXES

- A. Interior Wiring:
 - 1. Outlet and Pull Boxes. Pressed steel, zinc coated with plaster ring where applicable. NEMA OS1, UL 514A.
 - 2. Large Junction and Pull Boxes. Fabricated sheet steel, zinc coated or baked enamel finish, with return flange and screw retained cover.
 - 3. Concrete and Masonry. Specifically designed boxes for casting in concrete or mounting in masonry walls for that purpose.
 - 4. Mounting. Provide boxes with fan side box support Caddy J1A series or Caddy quick mount H series.
- B. Exterior Wiring:
 - 1. Above Grade:
 - a. Outlet and junction boxes: Cast or malleable iron or cast of corrosion resistant alloy, complete with conduit hubs, compatible with raceway to which it is connected. NEMA FB1.
 - b. Pull boxes: Fabricated steel and hot dipped galvanized complete with malleable iron hubs.
 - c. All boxes labeled for damp (NEMA 3R) or wet (NEMA 4) locations as applicable.

2.14 ACOUSTICAL SEALANT (SOUND ISOLATION PADS)

- A. Manufacturer's standard sheet sealant. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Non Fire Rated Assemblies:
 - a. Lowry's Electrical Box Sealer
 - b. Tremco sheet caulking
 - 2. Fire Rated Assemblies:
 - a. "Firestop Putty Pads" by Hevi-duty/Nelson.
 - b. Specified Technologies, Inc.

c. HILTI CP-617

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

- A. Interior: Use the following wiring methods:
1. Exposed: Electric Metallic Tubing.
 2. Exposed Subject to Damage (i.e. from vehicles, carts and moving pallets including stubups in concrete): Rigid Steel or Intermediate Metal Conduit.
 3. Concealed: Electric Metallic Tubing.
 4. Connection to Vibrating Equipment (including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Flexible Metal Conduit, (except in wet or damp locations, use Liquidtight Flexible Metal Conduit) with 90° loop, maximum 6 feet long.
- B. Exterior: Use the following wiring methods:
1. Exposed: Rigid Steel Conduit or Intermediate Metal Conduit.
 2. Concealed: Rigid Steel Conduit, or Intermediate Metal Conduit.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Liquidtight Flexible Metal Conduit.
 4. Boxes and Enclosures: NEMA 250, NEMA type 3R or type 4.
- C. Raceway Embedded in Slabs
1. Install only to flush floor boxes. Do not install other raceways in slabs.
 2. Install in middle third of slab thickness and leave at least 1-inch (25-mm) concrete cover.
 3. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 4. Space raceways laterally to prevent voids in concrete.
 5. Protect stub-ups from damage where conduits rise through floor slabs. Transition from nonmetallic conduit to rigid steel conduit, or IMC before rising above floor. Arrange so curved portion of bends is not visible above the finished slab.
- D. Hazardous Locations: Use the following wiring methods:
1. Rigid Steel or Intermediate Metal Conduit.
 2. Boxes and Enclosures: Cast Metal Boxes, NEMA FB1.

3.3 INSTALLATION

- A. Provide raceways concealed in construction unless noted otherwise or unless specifically authorized by the Architect.

- B. Install raceways level and square and at proper elevations. Provide not less than 6'-6" (200cm) headroom. Where raceways are installed in exit pathways provide not less than 7'-0" headroom. Do not block access to junction boxes, valves, mechanical equipment or prevent removal of ceiling panels, etc.
- C. Complete raceway installation before starting conductor installation.
- D. Use raceway fittings compatible with raceways and suitable for use and location.
- E. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members and follow the surface contours.
 - 1. Run parallel or banked raceways together, on common supports where practical.
 - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- F. Join raceways with fittings designed and approved for the purpose and make joints tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
- G. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box. Provide bushings on all raceways 1-1/2" (40mm) and larger.
- H. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- I. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.
- J. Size raceways not sized on the drawings per manufacturers shop drawings, applicable standards or other section of this specification.
- K. Maintain 12" (300mm) minimum clearance to high temperature (greater than 90°C) surfaces.
- L. When construction involves masonry work, assemble and install raceways at the same time as the wall is erected. Avoid surface cut masonry units whenever such units are to remain unplastered or uncovered in completed construction.
- M. Minimum raceway sizes shall be as follows:
 - 1. Branch Circuits 3/4" trade size
 - 2. Home Runs 3/4" trade size
 - 3. Runs terminating in one switch or one receptacle shall be 1/2" trade size
- N. Conduit home runs shall extend from ceiling outlets or junction boxes in lieu of wall outlets.

3.4 RIGID METAL AND INTERMEDIATE METAL CONDUIT

- A. All connections watertight.
- B. Provide plastic coated rigid steel or IMC conduit for all exposed exterior raceways. Use only fittings approved for use with PVC coated raceways. Patch all nicks and scrapes in PVC coating after installing conduits.

3.5 SURFACE METAL RACEWAY

- A. Verify exact mounting and locations with Architect prior to rough-in. Install parallel to a building surface (i.e., wall, ceiling, floor) and fasten to surface as recommended by manufacturer. Mount so raceway is in the least obvious location. Provide all required boxes, extensions, fittings, elbows and devices for a complete installation. Ream all cuts smooth and provide bushings in ends of $\frac{1}{2}$ " (15mm) and $\frac{3}{4}$ " (20mm) runs at all boxes and devices.

3.6 RIGID NONMETALLIC CONDUIT

- A. May be used where specified in 3.2 above. Exception: Use rigid steel for elbows, penetrations through floors and walls and stub ups. Raceway size may need to be increased to include code required ground wire. Field bends limited to less than 44 degrees, formed with manufacturer's recommended heater.

3.7 RACEWAY PENETRATION SEALS

- A. Exterior wall surfaces above grade: Provide watertight seal around all raceways. For concrete construction above ground level, cast raceway in wall or core drill wall and hard pack with a mixture of equal parts of sand and cement. For other types of construction use method acceptable to Architect.
- B. Exterior surfaces below grade: Provide watertight seal around all raceways. Cast raceway into wall (or floor) or use manufactured seal assembly.
- C. Roofs: Provide flashed and hot mopped weatherproof seal, or a pitch pan filled and sealed to be weatherproof where raceway penetrates roof membrane. Provide a weatherhead on all raceway stubups penetrating roof.
- D. Fire rated construction: Seal penetrations to maintain fire rating of construction penetrated as specified in Division 7 Firestopping.

3.8 RACEWAYS SEALING FITTINGS

- A. Provide watertight seal in the interior of all raceways which pass through building roof, ground floor slab or through outside walls of the building above or below grade. Seal on the end inside the building, using raceway sealing fittings manufactured for the purpose. Locate fittings at suitable accessible locations. For concealed raceways install each fitting in a flush steel box with a blank coverplate to match finish of adjacent plates or surfaces.

Exception: Sealing fittings are not required on raceways through the floor slab when the raceway does not extend beyond the building footprint.

- B. Provide sealing fittings or duct seal in j-box for all raceways entering freezers and refrigeration units.

3.9 HANGERS FOR RACEWAYS

- A. Raceways 1" and larger: Provide lay-in pipe hangers on 1/4" (6mm) or larger all threaded rods attached to metal ceiling inserts or to structural members at not greater than 10'-0" (3m) on center and within 12" (300mm) of each change in direction.
- B. When more than two raceways will use the same routing, group together on a channel trapeze support system supported by 3/8" (9.5mm) (minimum) threaded rods attached to metal ceiling inserts or structural members. Size supports for multiple raceways for 25% future capacity.
- C. Suspended ceiling systems: Do not attach raceways to ceiling suspension system hangers. Raceways 3/4" (20mm) and smaller serving equipment located within ceiling cavity or mounted on or supported by the ceiling grid system may be supported by dedicated #12 ga. galvanized, soft annealed mild steel wire hangers. Two raceways maximum per hanger. Attach raceways with clips manufactured for the purpose.

3.10 EXPANSION FITTINGS

- A. Provide expansion fittings for raceways crossing expansion joints, building separation walls, and seismic joints. Provide bonding jumper.

3.11 VERTICAL CABLE SUPPORTS

- A. Provide cable support for vertical cable runs as required by NFPA 70.

3.12 STUB-UP CONNECTIONS

- A. Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches (150 mm) above the floor. For future equipment connections install threaded plugs flush with floor.

3.13 OUTLET AND JUNCTION BOXES

- A. Firmly anchor boxes directly or with concealed bracing to building studs or joists. Boxes must be so attached that they will not "rock" or "shift" when devices are operated.
- B. Flush Mounting: Install front edge (box or plaster ring) even with the finished surface of the wall or ceiling, except for those mounted above accessible ceilings or where drawings indicate surface mounting is permitted.
- C. Do not mount flush boxes back-to-back. Provide 6" (150mm) minimum horizontal separation between closest edges of the boxes. Option: Use sound isolation pads or other sound proofing method acceptable to Architect.

- D. When boxes are installed in fire resistive walls and partitions provide 24" (600mm) horizontal separation between boxes on opposite sides of a wall in accordance with IBC 712.3.2. In addition, limit penetrations to 16 square inches (103 square centimeters) per penetration and not to exceed a total of 100 square inches per 100 square feet (9.3 square meters) of wall area. Option: Apply fire stop putty pads acceptable to the fire marshal.
- E. For all electrical outlets penetrating the ceiling and walls in partition types in patient care areas as shown on the drawings provide acoustical sealant putty per Paragraph 2.14 around the outside (backside) of all boxes to prevent air leakage around or through the boxes.

3.14 ELECTRICAL OUTLETS

- A. General: Coordinate the work of this Section with the work of other Sections and trades. Study all drawings that form a part of this contract and confer with the various trades involved to eliminate conflicts between the work of this Section and the work of other trades. Check and verify outlet locations indicated on Architectural drawings, door swings, installation details and layouts of suspended ceilings and locations of all plumbing, heating and ventilating equipment.
- B. Centered on Built-In Work: In the case of doors, cabinets, recesses or similar features, or where outlets are centered between two such features, such as between a door jamb and a cabinet, make these outlet locations exact. Relocate any outlets which are located off center.
- C. Vertical and Horizontal Relationships: Align outlets exactly on center lines horizontally or vertically where more than one outlet is shown or specified to be at the same elevation or one above the other. Relocate as directed all such outlets (including lighting, receptacle, power, signal and thermostat outlets) which are not so installed, at no additional cost to Owner.
- D. Device Outlet Height: Measure from the finished floor to the center line, unless otherwise noted.

Switches	4 feet, set vertically
Receptacles	18 inches, set vertically or as indicated
Telephone	18 inches, set vertically or as indicated
Other	As noted or as directed by Architect
- E. Ceiling Location: Locate outlet either at the corner joint or in the center of a panel for acoustical material, whichever is closer to the normal spacing. Locate all outlets in the same room in same panel position.

3.15 LIGHTING FIXTURES

- A. In ceilings of Acoustical Material: Locate in accordance with approved ceiling layout plans and so that fixtures replace full size ceiling tiles wherever possible.

3.16 ELECTRICAL WORK IN COUNTERBACKS, MILLWORK AND CASEWORK

- A. Provide templates, where required, to other trades for drilling and cutting to insure accurate location of electrical fixtures (outlets and devices) as verified with the Architect.
- B. Provide all wiring, devices, plates and connections required by said fixtures.

3.17 CONNECTION TO EQUIPMENT

- A. Provide outlet boxes of sizes and at locations necessary to serve equipment furnished under this or other Divisions and provide final connections to all equipment.
- B. Outlet box required if equipment has pigtail wires for external connection, does not have space to accommodate circuit wiring or requires a wire with insulation rating different from circuit wiring used.
- C. Study equipment details to assure proper coordination.

3.18 BLANK COVERS

- A. Provide blank covers or plates to match coverplates specified in section 262726 over all boxes that do not contain devices or are not covered by equipment.

3.19 DEVICE BOXES CONTAINING EMERGENCY AND NORMAL DEVICES

- A. Permitted only with steel barrier manufactured especially for the purpose of dividing the box into two completely separate compartments.

3.20 DEVICE BOXES CONTAINING MULTIPLE DEVICES AND WIRING RATED OVER 150 VOLTS TO GROUND AND OVER 300 VOLTS BETWEEN CONDUCTORS

- A. Permitted only with steel barrier manufactured especially for the purpose of dividing the box into separate compartments for each device having exposed live parts.

3.21 JUNCTION OR PULL BOXES

- A. Pull and junction boxes: Install as shown, or as necessary to facilitate pulling of wire and to limit the number of bends within code requirements.
- B. Permanently accessible.
- C. Do not intermix conductors from one system in same junction box or pull box as another system unless shown or specifically authorized otherwise.
- D. In suspended ceiling spaces: Support from structure independently from ceiling suspension system.
- E. The drawings do not necessarily show every pull or junction box required. Add all required boxes.

3.22 COLOR CODING

- A. Color Code all junction boxes installed in accessible ceiling spaces and exposed in unfinished areas using spray paint on the box and entire cover in the following manner:

480 Power	Brown	Telephone	Black
277V Lighting	Yellow	Nurse Call	Lt. Blue
120/208V	Unpainted	Paging	Silver
Emergency Power	Orange	Television	Gold

Clock
Fire Alarm

Green
Red

Intrusion Alarm
CCTV

Gray
Gray

- B. Use black felt tip marker following painting to indicate the system and circuit numbers in 1" (25mm) high letters contained within.

END OF SECTION