

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing.
2. Fittings for conduit, tubing, and cables.
3. Threaded metal joint compound.
4. Surface metal raceways and fittings.
5. Wireways and auxiliary gutters.
6. Metallic outlet boxes, device boxes, rings, and covers.
7. Termination boxes.
8. Cabinets, cutout boxes, junction boxes, and pull boxes.
9. Cover plates for device boxes.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260529 " Hangers and supports for electrical system."for bracing of raceways, boxes enclosures and cabinets .
3. Section 262726 "Wiring devices" for device installed in boxes and for floor-box service fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Wireways and fittings .
2. Surface metal raceways.
3. Floor boxes.
4. Cabinets and cutout boxes and enclosures.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details. Show that floor boxes are located to avoid interferences and are structurally allowable. Indicate floor thickness at location where boxes are embedded in concrete floors and underfloor clearances where boxes are installed in raised floors.

C. Samples: For wireways , surface raceways, and floor boxes for colors and textures specified, .

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING:

Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. TYPE EMT-S RACEWAYS AND ELBOWS Comply with UL 797 and UL Category Control Number FJMX.

Exterior Coating: Zinc, Alternate corrosion-resistant coating.
Interior Coating: Zinc.
2. TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES Comply with UL 6 and UL Category Control Number DYIX.
3. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples: Exterior , Interior Coating: Zinc.
4. PVC-Coated-Steel Electrical Rigid Metal Conduit (ERMC-S-PVC), Elbows, Couplings, and Nipples:
 - a. Exterior Coating: PVC complying with NEMA RN 1.
 - b. Interior Coating: Zinc.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
5. TYPE FMC-S AND TYPE FMC-A RACEWAYS Comply with UL 1 and UL Category Control Number DXUZ.
6. TYPE IMC RACEWAYS Comply with UL 1242 and UL Category Control Number DYBY.
7. Steel Electrical Intermediate Metal Conduit (IMC):

- a. Exterior Coating: Zinc, Alternative corrosion-resistant coating.
- b. Interior Coating: Zinc.
8. TYPE LFMC RACEWAYS and Conduit Comply with UL 360 and UL Category Control Number DXHR.

2.2 FITTINGS FOR CONDUIT, TUBING, AND CABLE

Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

1. Fittings for Type ERM, Type IMC, EMT, FMC, LFMC Raceways: Comply with UL 514B
 - a. Material: Steel.
 - b. Coupling Method: Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.3 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use. plumbing compounds and tapes are not permitted by NFPA 70 because they are not conductive.
2. General Characteristics: UL 2419 and UL Category Control Number FOIZ.

2.4 SURFACE METAL RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 5 and UL Category Control Number RJBT.

B. Surface Metal Raceways and Fittings with Metal Covers:

1. Galvanized steel Galvanized steel with snap-on covers complying with UL 5.
2. Wiring Channels: Single, Dual, Triple. Multiple channels must be capable of housing a standard 20 to 30 A NEMA device flush within the raceway.

2.5 WIREWAYS AND AUXILIARY GUTTERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 870 and UL Category Control Number ZOYX.

B. Metal Wireways and Auxiliary Gutters:

1. Additional Characteristics:
 - a. Fittings and Accessories: Include covers, 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.
 - b. Finish: Manufacturer's standard enamel finish.

2.6 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 514A and UL Category Control Number QCIT.

B. Metallic Outlet Boxes:

1. Description: Box having pry out openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Options:
 - a. Sheet Metal Depth: Minimum 1.5 inch (38 mm) , 2 inch (50 mm), 2.5 inch (65 mm), 2.8 inch (70 mm), 3.5 inch (90 mm) refer to NFPA 70, Table 314.16(A) for permitted conductor quantities for each size box.
 - b. Cast-Metal Depth: Minimum 1.8 inch (44.5 mm), 2.4 inch (60.3 mm).
 - c. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing [up to 50 lb (23 kg)] [more than 50 lb (23 kg) and marked with maximum allowable weight].
 - d. Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb (32 kg).

C. Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point.

D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

E. Metallic Floor Boxes and Floor Box Covers:

1. Material: Sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 TERMINATION BOXES

- A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
- B. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL 1773 and UL Category Control Number XCKT.
- C. Termination Boxes and Termination Bases for Installation on Line Side of Service Equipment:
1. Additional Characteristics: Listed and labeled for installation on line side of service equipment.
- D. Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment:
1. Additional Characteristics: Listed and labeled for installation on load side of service equipment.

2.8 CABINETS, JUNCTION BOXES, AND PULL BOXES

- A. Performance Criteria:
1. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
 2. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 3. General Characteristics:
 - a. Non-Environmental Characteristics: UL 50.
 - b. Environmental Characteristics: UL 50E.
- B. Cabinets:
1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Indoor Sheet Metal Junction and Pull Boxes:
 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Additional Characteristics: NEMA OS 1.
- E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover
- F. Cast-Metal Access ,Junction and Pull Boxes:
 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 2. Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)
- I. Gangable boxes are allowed

2.9 COVER PLATES FOR DEVICES BOXES

- A. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics:
 - a. Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - b. Wallplate-Securing Screws: Metal with head color to match wallplate finish.
- B. Metallic Cover Plates for Device Boxes:
 1. Options:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
1. Exposed and Subject to Severe Physical Damage: ERMC.
 2. Exposed and Subject to Physical Damage: ERMC.
 3. Exposed and Not Subject to Physical Damage: GRC.
 4. Concealed Aboveground: GRC or EMT.
 5. Concrete Encased Not in Trench: PVC-80.
 6. Concrete Encased in Trench: PVC-80 or PVC-40.
 7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 8. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R
- C. Indoors:
1. Hazardous Classified Locations: GRC.
 2. Exposed and Subject to Severe Physical Damage: GRC. Subject to severe physical damage includes the following locations:
 - a. Mechanical rooms.
 - b. Gymnasiums.
 - c. Elevator Shafts.
 3. Exposed and Subject to Physical Damage:GRC. Subject to physical damage includes the following locations:
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 - b. Stub-ups to above suspended ceilings.
 4. Exposed and Not Subject to Physical Damage: EMT.
 5. Concealed in Ceilings and Interior Walls and Partitions: FMC.
 6. Damp or Wet Locations: GRC and LFMC.
 7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
- D. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- E. Raceway Fittings:Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.

3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

3.2 SELECTION OF BOXES AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:

- a. Type 4 unless otherwise indicated.
- b. Locations Exposed to Hosedown: Type 6.
- c. Locations Subject to Potential Flooding: Type 6P.
- d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
- e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
- f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.

2. Indoors:

- a. Type 1 unless otherwise indicated.
- b. Damp or Dusty Locations: Type 4.
- c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
- d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
- e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4.
- f. Locations Exposed to Hosedown: Type 6.
- g. Locations Exposed to Brief Submersion: Type 6.
- h. Locations Exposed to Prolonged Submersion: Type 6P.
- i. Locations Exposed to Corrosive Agents: Type 4X.
- j. Locations Exposed to Spraying Oil or Coolants: Type 13.

3.3 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

3. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
4. Comply with NECA NEIS 101 for installation of steel raceways.
5. Comply with NECA NEIS 102 for installation of aluminum raceways.
6. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
7. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts..
8. Raceway Terminations at Locations Subject to Moisture or Vibration:

B. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.
2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of **2 ft** above finished floor.
3. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within **12 inch (300 mm)** of changes in direction.
4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within **12 inch (300 mm)** of enclosures to which attached.
7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where an underground service raceway enters a building or structure.
 - c. Conduit extending from interior to exterior of building.
 - d. Conduit extending into pressurized duct and equipment.
 - e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - f. Where otherwise required by NFPA 70.
9. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
10. Do not install conduits within **2 inch (50 mm)** of the bottom side of a metal deck roof.
11. Keep raceways at least **6 inch (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

12. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
 13. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than **200 lb (90 kg)** tensile strength. Leave at least **12 inch (300 mm)** of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- C. Requirements for Installation of Specific Raceway Types:
1. Types EMT-A, ERMC-A, and FMC-A:
 - a. Do not install aluminum raceways or fittings in contact with concrete or earth.
 2. Types ERMC and IMC:
 - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
 3. Types FMC and LFMC:
 - a. Comply with NEMA RV 3. Provide a maximum of **36 inch** of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- D. Raceways Embedded in Slabs:
1. Run raceways larger than 1-inch (trade size 1) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place raceway close to slab support. Secure raceways to reinforcement at maximum **10 ft (3 m)** intervals.
 2. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint.
 3. Arrange raceways to ensure that each is surrounded by a minimum of **2 inch (50 mm)** of concrete without voids.
 4. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.
- E. Stub-ups to Above Recessed Ceilings:
1. Provide EMT, IMC, or ERMC for raceways.
 2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- F. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
1. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

2. EMT: Provide setscrew, steel cast-metal fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

3.4 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceways only where indicated on Drawings.
- B. Install surface raceway with a minimum **2 inch (50 mm)** radius control at bend points.
- C. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding **48 inch (1200 mm)** and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.5 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated below;
 1. Convenience Receptacles: 14" above finish floor, 18" above finish floor for ADA adaptable apartments.
 2. Wall Switches: 48" above finish floor, 46" above finish floor for ADA adaptable apartments.
 3. Combination Wall switches/Receptacles: 48" above finish floor, 46" above finish floor for ADA adaptable apartments.
 4. Air Conditioner Receptacles: 14" above finish floor, 18" above finish floor for ADA adaptable apartments.
 5. Kitchen Appliance Countertop Receptacles: 46" above finish floor, 44" above finish floor for ADA adaptable apartments.
 6. Refrigerator Receptacle: 54" above finish floor.
 7. Range Receptacle: 30" above finish floor.
 8. Range Hood: 70" above finished floor and centered behind the range hood for hardwire connection to the exhaust fan and light contained therein. *In all ADA handicapped adaptable apartments, a 15-Ampere single pole wall switch shall be provided, at a height of 46" above finished floor, to simultaneously control the ON/OFF operation of the hood fan and light.*
 9. If mounting heights of boxes are not individually indicated, give priority to ADA
- C. requirements. Install boxes with height measured center. Apartment Circuit Breaker Panel Cabinet heights indicated below: 72" above the finish flooring, 48" above finish floor ADA adaptable apartments.
- D. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.

- E. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- F. Locate boxes so that cover or plate will not span different building finishes.
- G. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- H. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- I. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- J. Set metal floor boxes level and flush with finished floor surface.
- K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
- M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - 2. Provide gaskets for wallplates and covers.

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

3.8 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION 260533