**Microsoft WAW02**

Section 26 05 33

Raceway & Boxes for

Electrical Systems

**Raceways & Boxes for Electrical Systems**

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Note

All item of plant, equipment and fittings need to be designed and installed to meet all the requirements specified in IS- and EN- standards and which are applicable to the facility, placing and its function. All items must remain operable in that Zone for the prescribed operational times or period of operation.

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# General

## Summary

* + 1. Section Includes:
       1. Rigid metal conduit (RMC) and fittings.
       2. Intermediate metal conduit (IMC) and fittings.
       3. Electrical metallic tubing (EMT) and fittings.
       4. Flexible metal conduit (FMC) and fittings.
       5. Liquidtight flexible metal conduit (LFMC) and fittings.
       6. Rigid nonmetallic conduit (RNC) and fittings.
       7. Electrical nonmetallic tubing (ENT) and fittings.
       8. Liquidtight flexible nonmetallic conduit (LFNC) and fittings.
       9. Metal wireways.
       10. Boxes and condulets.
       11. Hinged cover enclosures
       12. Cabinets.

## Definitions

* + 1. Refer to Section 26 05 00, “Common Work Results for Electrical” and Section 01 42 00, “References” for common definitions used throughout all specifications.

## References

* + 1. Refer to Section 01 42 00, “References” for common references used throughout all specifications.
    2. Refer to Section 27 05 28, “Pathways for Telecommunications Systems” for related requirements.

## Submittal Documentation Requirements

* + 1. Refer to Section 01 33 00, "Submittal Procedures" for submittal documentation requirements.

## Submittals

* + 1. Action Submittals:
       1. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
       2. Shop Drawings: Where custom enclosures and cabinets are used, include plans, elevations, sections, details, and attachments to other work.
       3. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
          1. Structural members in the paths of conduit groups with common supports.
          2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
       4. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Section 26 05 30, “Vibration and Seismic Controls for Electrical Systems.” Include the following:
          1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

1. The term “withstand” means “the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event.”
   * + - 1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
         2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
       1. Qualification Data: For professional engineer and testing agency.
       2. Source quality-control test reports.

## Site Conditions

* + 1. Refer to Section 26 05 00, “Common Work Results for Electrical” for site conditions applicable to this project.

## Quality Assurance

* + 1. Refer to Section 26 05 00, “Common Work Results for Electrical” and Section 01 40 00, “Quality Requirements” for typical quality assurance requirements.
    2. Electrical Components, Devices, and Accessories: Listed and labeled, per IEC 60364, and which is acceptable to the authority having jurisdiction, and marked for intended use.
    3. Cable tray, ladder, basket and trunking shall comply with EN 50085 Hot-Dip Pre-Galvanised to EN 10346 within any IT critical environment. The trunking body will have a return edge on its opening side and the steel shall not be less than 1.4mm thick.
    4. Raceways, containment systems and boxes shall comply with following: Manufacturing standard EN 61537; Galvanising standard Hot-dip galvanised to EN ISO 1461 after manufacture.
    5. EN 50085-2-1; Cable containment systems and cable ducting systems for electrical installations. Cable containment systems and cable ducting systems intended for mounting on walls and ceilings.
    6. Comply with CENELEC (European Committee for Electrotechnical Standardisation).
    7. Comply with the following standards:
       1. IEC 60423 Conduit systems for cable management - Outside diameters of conduits for electrical installations and threads for conduits and fittings
       2. IEC 61386 Conduit systems for cable management
       3. IEC 61950 Cable management systems - Specifications for conduit fittings and accessories for cable installations for extra heavy duty electrical steel conduit

## Delivery, Storage and Handling

* + 1. Refer to Section 26 05 00, “Common Work Results for Electrical” for typical requirements.

## Warranty

* + 1. Refer to Section 26 05 00, “Common Work Results for Electrical” for typical warranty requirements.

## Extra Materials (Not required)

# Products

## Metal Conduit and Tubing

* + 1. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be considered for incorporating into the Work include the following:
       1. Legrand
       2. Schneider Electric
       3. MK Electric
       4. AFC Cable Systems, Inc.
       5. Alflex Inc. A Southwire company.
       6. Allied Tube & Conduit; a Tyco International Ltd. Co.
       7. Anamet Electrical, Inc.; Anaconda Metal Hose.
       8. Electri-Flex Co.
       9. Prime Conduit
       10. Wheatland Tube Company.
       11. Owner- approved equivalent.
    2. RMC: EN50086-2-4; Specification for conduit systems for cable management and IEC 60981 rigid galvanised steel, rigid galvanized steel.
       1. Fittings and Conduit Bodies: Threaded type, steel. Do not use setscrew-type couplings, elbows, sweeps, or nipples. Provide bushings on each end of the conduit.
    3. IMC: IEC 60981; Rigid Galvanised Steel.
       1. Fittings and Conduit Bodies: Threaded type, steel . Do not use setscrew-type couplings, elbows, sweeps, or nipples. Provide bushings on each end of the conduit.
    4. PVC-Coated RMC: PVC-coated rigid steel conduit.
       1. Comply with EN 50086-2-1.
       2. Coating Thickness: 1 mm, minimum.
       3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 1 mm, with overlapping sleeves protecting threaded joints.
    5. EMT: EN 61386-24; Specification for conduit systems for cable management.
       1. Fittings and Conduit Bodies EN 61386, steel. Use setscrew-type or compression fittings. Provide bushings with insulated nonmetallic throats on each end of the conduit for all conduits.
    6. FMC: Zinc-coated steel, listed under EN50086-2-3.
       1. Fittings and Conduit Bodies: Steel.
    7. LFMC: Flexible steel conduit with PVC jacket, listed under IEC 61386 and EN 50086-2-3.
       1. Fittings and Conduit Bodies: Steel with PVC jacket.
    8. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.
    9. Metallic raceways shall be electrically continuous. Raceways shall be bonded to corresponding boxes or equipment enclosures, where they enter such equipment, using appropriate couplings, fittings, and locknuts as required by code or the local authority having jurisdiction.
       1. Earthing bushings with lay-in lugs shall only be provided where required for service entrance conductors.
       2. Provide insulated throat bushings for abrasion protection for the conductors as they exit the raceway.

## Nonmetallic Conduit and Tubing

* + 1. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include the following:
       1. AFC Cable Systems, Inc.
       2. Anamet Electrical, Inc.; Anaconda Metal Hose.
       3. Arnco Corporation. A Dura-Line company.
       4. CANTEX Inc.
       5. Condux International, Inc.
       6. Electri-Flex Co.
       7. Lamson & Sessions; Carlon Electrical Products.
       8. Manhattan/CDT/Cole-Flex.
       9. RACO; a Hubbell Company.
       10. Thomas & Betts Corporation.
       11. Owner- approved equivalent.
    2. RNC: IEC 60439-1 and IEC 61386-1:2008 (European Standard (EN)), listed under EN, unless otherwise indicated. Construct and mark conduit for use with 90-degree C rated conductors.
       1. Fittings and Conduit Bodies: IEC 61386-1; match to conduit or tubing type and material. Construct and mark fittings for use with 90-degree C rated conductors.
    3. ENT: listed under EN 50086-2-1, PVC.
       1. Fittings and Conduit Bodies: PVC.
    4. LFNC: Listed under EN IEC 61386, flexible plastic conduit.
       1. Fittings and Conduit Bodies: PVC.

## Metal Wireways

* + 1. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
       1. Schneider Electric.
       2. Legrand
       3. Schneider Electric
       4. MK Electric
       5. Owner- approved equivalent.
    2. Description: Sheet metal sized and shaped as indicated, complying with EN 50085-2-1 Cable trunking systems and cable ducting systems for electrical installations. Cable trunking systems and cable ducting systems intended for mounting on walls and suspended from ceilings, unless otherwise indicated.
    3. 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.
    4. Wireway Covers: Hinged type.
    5. Finish: Manufacturer's standard enamel finish.

## Boxes, Enclosures, and Cabinets

* + 1. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
       1. Schneider Electric.
       2. Legrand
       3. Schneider Electric
       4. MK Electric
       5. Owner- approved equivalent.
    2. Sheet Metal Outlet and Device Boxes: IEC 60670-1
    3. Nonmetallic Outlet and Device Boxes: IEC 60670-1; minimum depth 50 mm. Provide gasketed, watertight cover.
    4. Cast-Metal Outlet and Device Boxes: IEC 60670-1,, Type FD, with gasketed cover and threaded hubs; minimum depth 50 mm.
    5. Metal Floor Boxes: IEC 60670-1; Cast metal, Formed steel, fully adjustable, rectangular. Refer to drawings for specific requirements.
    6. Sheet Metal Pull and Junction Boxes for Interior Dry Location Installations:
       1. Boxes Having No Dimension Greater Than 1300 mm:
          1. EN 60670-1, galvanized steel.
       2. Boxes Larger Than 1300 mm in Any Dimension:
          1. See hinged cover enclosures within this Section.
    7. Cast-Metal Access, Pull, and Junction Boxes for Above-Grade Outdoor and Wet Location Installations:
       1. EN 60670-1, galvanized cast ferrous alloy box and cover with earth flange, neoprene gasket, and stainless steel cover screws.
    8. Hinged-Cover Enclosures:
       1. C/W with continuous-hinge cover with flush latch; unless otherwise indicated complying with IEC 61439-1.
       2. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
       3. Interior Panel for Mounting Terminal Blocks or Electrical Components: Steel, white enamel finish.
    9. Cabinets:
       1. Galvanized-steel box with removable front complying with IEC 61439-1. Finished inside and out with manufacturer's standard enamel.
       2. Finished inside and out with manufacturer's standard enamel.
       3. Hinged door in front cover with flush latch and concealed hinge.
       4. Key latch to match panelboards.
       5. Louvered, with filters, for ventilation of internal components.
       6. Interior Panel for Mounting Terminal Blocks or Electrical Components: Steel.
       7. Barriers to separate wiring of different systems and voltage.
       8. Protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.
       9. Accessory feet where required for freestanding equipment, as specified in Section 26 05 00, “Common Work Results for Electrical.”

# Execution

## Raceway Application

* + 1. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
       1. Exposed Conduit:
          1. [Galvanized steel RMC.]
          2. [Aluminum RMC [over [50 mm] ].]
          3. [IMC.]
          4. [PVC-coated steel RMC.]
          5. EMT – must use compression fittings
       2. Concealed Conduit, Aboveground:
          1. Galvanized steel RMC.
          2. RNC – in duct banks
          3. Aluminum RMC over 50 mm
          4. IMC.
          5. PVC – coated steel RMC.
          6. EMT – must use compression fittings.
       3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):
          1. 1.5 meter maximum lengths of LFMC with minimum 90-degree turn resulting in a loose and compliant connection.
          2. Provide flexible conduit long enough to allow item to which it is connected to be withdrawn or moved off its base.
          3. See additional requirements in Section 26 05 30, “Vibration and Seismic Controls for Electrical System.”
       4. Boxes and Enclosures, Aboveground: IEC 60529 IP65 minimum
    2. Indoors: Apply raceway products as specified below, unless otherwise indicated:
       1. Exposed, Not Subject to Physical Damage: EMT – acceptable to use setscrew-type fittings.
       2. Exposed and Subject to Severe Physical Damage: Galvanized steel RMC Aluminum RMC over 53 mmIMC. Includes raceways in the following locations:
          1. Loading dock.
          2. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
          3. Mechanical rooms.
       3. Concealed in Ceilings and Interior Walls and Partitions: EMT – acceptable to use setscrew-type fittings.
       4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):
          1. 1.5 meter maximum lengths of FMC (except use LFMC in damp or wet locations), with minimum 90 degree turn resulting in a loose and compliant connection.
          2. Provide flexible conduit long enough to allow item to which it is connected to be withdrawn or moved off its base.
          3. See additional requirements in Section 26 05 30, “Vibration and Seismic Controls for Electrical System.”
       5. Damp or Wet Locations:
          1. Galvanized steel RMC.
          2. IMC.
          3. EMT – must use compression fittings.
       6. Boxes and Enclosures: IEC 61439, stainless steel in damp or wet locations. To be IP 65 stainless steel
    3. Above Ground, Embedded in Concrete:

#### Galvanized steel RMC.

#### IMC.

#### RNC.

#### ENT.

* + 1. Raceway Fittings: Compatible with raceways and suitable for use and location.
       1. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
    2. Install nonferrous conduit or tubing for circuits operating above 50 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
    3. Do not install aluminum conduits in contact with concrete.
    4. Use of conduit bodies is not permitted unless specifically approved in advance, for a particular application, by the project engineer.
    5. Maintain a minimum of 150mm clearance between mechanical diffusers and conduits for proper air circulation/distribution

## Installation

* + 1. Comply with relevant IEC standards for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
    2. Keep raceways at least 150 mm away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
    3. Complete raceway installation before starting conductor installation.
    4. Building Expansion Joints - When a raceway crosses a building expansion joint, a flexible coupling shall be installed that will allow for the joints to expand and contract, and will prevent damage to the conductors due to this movement.
    5. Support raceways as specified in Section 26 05 29, “Hangers and Supports for Electrical Systems.”
    6. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
    7. Field bends for PVC conduit are acceptable.
       1. No open flame.
       2. No deformation of inside diameter of conduit.
    8. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
    9. Raceways Embedded in Slabs:
       1. Generally, raceways are to be run below floor slabs in concrete-encased duct banks, versus within the floor slabs. Conduits are only to be run within floor slabs where specifically indicated or approved.
       2. Run conduit larger than 25 mm trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
       3. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
       4. Change from RNC, Type EPC-40-PVC, to RMC or IMC before rising above the floor.
    10. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
    11. Pull Ropes and Pull Tapes:
        1. Install pull ropes or pull tapes secured at each end of each empty raceway, except sleeves and nipples.
        2. Use polypropylene rope nylon pull tape with printed footage indicators with not less than 91-kg tensile strength. Leave at least 300 mm of slack at each end of pull wire.
        3. Identify with tags at each end the origin and destination of each empty conduit, and indicate same as empty or spare conduit on as-constructed drawings.
    12. Raceways for Optical Fiber and Communications Cable: See Section 27 05 28, “Pathways for Telecommunications Systems.”
    13. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
        1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated or non-conditioned spaces.
        2. Where otherwise required by EN 54.
    14. Flexible Conduit Connections: Use maximum of 1.8 meters of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
        1. Use LFMC in damp or wet locations.
        2. Use FMC in dry indoor locations.
    15. 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.
    16. Set metal floor boxes level and flush with finished floor surface.
    17. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
    18. Containment passing through a fire rated wall shall be supported with a maximum distance of 300mm on both sides

## Protection

* + 1. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
       1. Comply with general protection requirements in Section 26 05 00, “Common Work Results for Electrical.”
       2. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
       3. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION