

SECTION 27 05 36
COMMUNICATIONS BUILDING PATHWAYS – CABLE TRAYS
Construction Specification

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Cable tray systems as pathways within buildings to support telecommunications, television, paging, and other signal (low voltage) systems
- B. Related Sections
 - 1. Comply with the Related Sections paragraph of Section 270000.
 - 2. Section 270526, "Communication Grounding and Bonding"
 - 3. Section 270528, "Communication Building Pathways"
 - 4. Section 270536, "Communication Building Pathways – Conduits and Boxes"
 - 5. Section 271100, "Communication Rooms"

1.2 REFERENCES

- C. Comply with the References requirements of Section 270000.
- D. In addition to those codes, standards, etc., listed in 270000, products (including fabrication process) and installation shall comply with the latest edition of the following applicable specifications and standards:
 - 1. ASTM International
 - a. ASTM A 123, "Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel"
 - b. ASTM A 510, "Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel"
 - c. ASTM A 525, "General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process"
 - d. ASTM A 580, "Standard Specification for Stainless Steel Wire"
 - e. ASTM A 591, "Specifications for Electrodepositing Coatings of Zinc on steel wire or sheets"
 - f. ASTM A 641, "Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire"
 - g. ASTM A 653, "Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process"
 - h. ASTM B 633, "Specification for Electrodeposited Coatings of Zinc on Iron and Steel"
 - i. ASTM D3451, "Standard Guide for Testing Coating Powders and Powder Coatings"
 - 2. International Electrotechnical Commission (IEC)
 - j. IEC 61537, "Cable Tray Systems and Cable Ladder Systems for Cable Management"
 - 3. National Electrical Manufacturer Association (NEMA)
 - k. NEMA VE 1 (also CAN/CSA C22.2 No. 126.1-09), "Metal Cable Tray Systems"

- I. NEMA VE 2, “Cable Tray Installation Guidelines”
- 4. National Fire Protection Agency (NFPA)
 - m. NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance”
 - n. NFPA 70E, “Standard For Electrical Safety In The Workplace”
- 5. Underwriters Laboratories (UL)
 - o. UL 467, “Grounding and Bonding Equipment”

1.3 DEFINITIONS

- E. Definitions of Section 270000 apply to this Section.
- F. In addition to those Definitions of Section 270000, the following list of terms as used in this Section defined as follows:
 - 1. “Cable Tray” and “Cable Tray System”: A unit or assembly of units or sections and associated fittings forming a structural system used to securely fasten or support cables and raceways
 - 2. “Wire Mesh Cable Tray”: A cable support and management system fabricated of continuous, rigid, welded steel wire mesh; available in many sizes with attachment hardware suiting multiple installation methods; falls under NFPA 70’s definition as cable tray

1.4 SYSTEM DESCRIPTION

- G. Work Covered Under Other Sections:
 - 1. Backbone Conduits/Duct Banks: Conduits, supports, pull boxes, and pull strings
 - 2. Sleeves: Sleeves (pre-fabricated systems and/or EMT conduits) and supports
- H. Wire Mesh Cable Tray Systems:
 - 1. Provide a complete cable tray system in accordance with CEC Article 392 and Article 250 (for Grounding and Bonding), NEMA VE 1, NEMA VE 2, manufacturer’s instructions, and compliant to local inspections and seismic restraint requirements, UL listing requirements, NFPA 70E, NECA’s “Standards of Installation” pertaining to general electrical installation practices, and recognized industry practices. Cable tray system shall conform to ANSI/TIA-569-B standard and BICSI TDMM guidelines. Complete shall include straight sections, connectors/splices, bonding straps, supports, etc., necessary for a complete installation.
 - 2. Supports: Provide supports at each connection point (junction of 2 or more straight sections), direction transitions, at the end of each run, and at other locations necessary to attain a fully supported and seismically braced cable tray system using a structurally-approved anchoring system and in accordance with NEMA VE 2.
 - a. Allowable Support Methods:
 - 1. Trapeze (NEMA VE 2)
 - 2. Single hanger clip (NEMA VE 2)
 - 3. Wall cantilever (NEMA VE 2)
 - 4. Wall vertical (NEMA VE 2)
 - b. Disallowable Support Methods:
 - 1. Center hung (NEMA VE 2)

3. Seismic Bracing: Provide seismic bracing to supports and tray system. Seismic bracing shall be approved by a structural engineer licensed in the state of California.
 4. Splices: Provide UL classified splice systems by the same manufacturer as the straight sections.
 - c. Allowable Splice Methods: washer splice, splice plate, splice bar, wing splice (all splice methods shall be UL Classified)
 5. Bend Radius: Cable tray system shall maintain a 12" (minimum) bend radius throughout.
 6. Provide radius shields at each bend/corner of "T" type intersections and cross intersections.
 7. Vertical Offsets: At vertical offsets 36 inch or less, provide a cable dropout on the higher level tray section. At vertical offsets greater than 36 inches, provide a section of tray installed vertically between the upper and lower tray levels.
 8. Bonding and Grounding
 - d. Cable tray shall be electrically continuous maintaining minimum metal area requirements per NFPA 70 Table 392.7 (for use as an equipment grounding conductor). Where straight sections or field fittings have been modified during installation such that wires have been removed, provide bonding straps or other approved accessories to maintain minimum continuous area per electrical code.
 - e. Provide external bonding strap at connections, expansion joints, sleeves, crossovers, and at other locations where system continuity is interrupted.
 - f. Bond cable tray system to approved ground, as per CEC Article 250, using approved connection means.
 9. Dropouts:
 - g. Provide dropouts where cables exit from tray system.
 - h. In locations that require 18" wide or 24" wide dropouts, combine one 12" wide dropout with one 6" wide dropout to create an 18" wide dropout, or two 12" wide dropouts to create a 24" wide dropout.
 10. Provide blind ends where tray termination is exposed (e.g., not at a wall).
- I. Cable Tray Systems:
1. Provide a complete cable tray system in accordance with CEC Article 392 and Article 250 (for Grounding and Bonding), NEMA VE 1, NEMA VE 2, NEMA FG 1, manufacturer's instructions, and compliant to local inspections and seismic restraint requirements, UL listing requirements, NFPA 70E, NECA's "Standards of Installation" pertaining to general electrical installation practices, and recognized industry practices. Cable tray system shall conform to ANSI/TIA-569-B standard and BICSI TDMM guidelines. Complete shall include straight sections, fittings, connectors/splices, bonding straps, supports, etc., necessary for a complete installation.
 2. Supports: Provide supports at each connection point, direction transitions, at fittings, at the end of each run, and at other locations necessary to attain a fully supported and seismically braced cable tray system using a structurally-approved anchoring system and in accordance with NEMA VE 2.
 - i. Allowable Support Methods:
 1. Trapeze (NEMA VE 2)
 2. Single hanger clip (NEMA VE 2)

3. Wall cantilever (NEMA VE 2)
 4. Wall vertical (NEMA VE 2)
 - j. Disallowable Support Methods:
 1. Center hung (NEMA VE 2)
 3. Seismic Bracing: Provide seismic bracing to supports and tray system. Seismic bracing shall be approved by a structural engineer licensed in the state of California.
 4. Splices: Provide UL classified splice systems by the same manufacturer as the straight sections.
 5. Expansion Connections: Provide expansion connectors where required per NEMA VE 1 and/or NEMA VE 2 and per manufacturer's instructions.
 6. Bend Radius: Cable tray system shall maintain a 12" (minimum) bend radius throughout.
 7. Vertical Offsets: At vertical offsets 36 inch or less, provide a cable dropout on the higher level tray section. At vertical offsets greater than 36 inches, provide a section of tray installed vertically between the upper and lower tray levels.
 8. Bonding and Grounding
 - k. Cable tray shall be electrically continuous maintaining minimum metal area requirements per CEC Table 392.7 (for use as an equipment grounding conductor).
 - l. Bond cable tray system to approved ground, as per CEC Article 250, using approved connection means.
 9. Provide blind ends where tray termination is exposed (e.g., not at a wall).
- J. Clearances (minimum):
1. Installation heights and clearances between cable tray and building structures: 12 inches
 2. Side and top access clearance: 12 inches
 3. From fluorescent light fixtures, or other EMI sources: 6 inches
 4. From any motor, transformer: 48 inches
 5. From flue, hot water, steam line or other non-insulated heat sources: 12 inches
- K. Penetrations:
1. Penetrate partitions and other construction assemblies, including fire rated assemblies, smoke barriers, smoke partitions, acoustic rated assemblies, etc., using approved methods.
 2. When penetrating concrete walls (including shear walls) and/or floors, scan the area to be penetrated and core openings using methods approved by the structural engineer and by the AHJ. Obtain written approval for locations and means when not using methods included in the contract documents.
 3. When penetrating fire rated assemblies, provide UL Classified and FM Approved fire rated systems in accordance with ASTM E814 (UL1479). Provide solid bottom type cable tray with a solid cover extending 24 inches from the finished surface of the wall on both sides. Provide labels at both sides of the penetration. Refer to drawings for approved systems per application.

4. When penetrating acoustic rated assemblies, provide solid bottom type cable tray with a solid cover extending 18 inches from the finished surface of the wall on both sides. Provide sealant to fill gaps, cavities, etc, to fully seal penetration.

1.5 SUBMITTALS

- L. General: Conform to Submittal requirements as described in Section 270000.
- M. Quantity: Furnish quantities of each submittal as noted in Section 270000.
- N. Submittal Requirements Prior to the Start of Construction:
 1. Product Data: Submit product data showing manufacturers, part numbers, dimensions, fabrications materials, fabrication details, finishes, capacities, and accessories; also include certifications (factory-certified test reports of specified products, complying with IEC 61537, CEC, and NEMA VE 1)
 - a. Submittal should include manufacturer's certification indicating ISO 9001 quality certified
 2. Shop Drawings: Submit shop drawings consisting of the following:
 - b. Cable tray layout/routes, supports locations, support details
 - c. Highlight proposed changes to pathways (routes, types, sizes, etc.) compared to the contract documents
 - d. Clearance variations and/or requests for exceptions
 - e. Seismic bracing details (also see "Seismic Calculations" below)
 - f. Instances of penetrations through fire and smoke rated barriers, including calling out firestopping type/UL System, size, quantity, and other relevant information
 3. Seismic Calculations: Submit seismic calculations for support systems in conformance Section 270000. Structural Calculations shall be prepared and signed by a California Registered Structural Engineer. If used, specify proof loads for drilled-in anchors.
- O. Submittal Requirements at Close Out:
 1. As-Built Drawings, showing the routes, dimensions, types, sizes, quantities, etc. (minimum)
 2. O&M Manual, including as-builts, parts list, repair information, and maintenance requirements
- P. Substitutions
 1. Requests for substitutions shall conform to the general requirements and procedure outlined in Section 270000.

1.6 QUALITY ASSURANCE

- Q. Comply with Quality Assurance requirements of section 270000.
- R. Manufacturer shall make available test reports witnessed by an independent testing laboratory of the "worst case" loading conditions and performed in accordance with the latest revision of NEMA VE 1
- S. Materials and installation shall comply with CEC – construction and installation of cable tray and cable channel systems per Article 318, bonding per Article 250, and other articles as applicable per instance.

- T. Installation shall comply with NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance”.

1.7 DELIVERY, STORAGE, AND HANDLING

- U. Comply with Delivery, Storage and Handling requirements of section 270000.

1.8 WARRANTY

- V. Comply with Warranty requirements of section 270000.

PART 2 PRODUCTS

2.1 CABLE TRAY – WIRE MESH TYPE

- A. Application: Suitable for the overhead support and management of communications cables.
- B. Tray shall be manufactured in accordance with NEMA VE1.
- C. Material: Straight sections shall be fabricated from high strength steel wires and formed into a 2-inch by 2-inch (or 2-inch by 4-inch) wire mesh pattern with welded wire intersections. Wires shall meet the minimum mechanical properties of ASTM A510 Longitudinal wires shall be straight (with no bends). Wires diameter should be approximately 0.16” (4mm). Wire ends shall be rounded during manufacturing (for safety of cables and installers) or T-welded to the top wire along sides (flanges).
- D. Finish: Electro-plate SC2 yellow zinc chromate, in accordance with ASTM B633.
- E. Finishes:
 - 1. Electro-Plated Zinc Galvanizing: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A 510, Grade 1008 and shall be electro-plated zinc in accordance with ASTM B633, Type III, SC-1.
- F. Splicing assemblies shall be the bolted-type using serrated flange locknuts. Hardware shall have yellow zinc chromate finish, in accordance with ASTM B633.
- G. Size: Refer to Drawings for sizes.
- H. Manufacturers:
 - 1. Chalfant Manufacturing wire mesh cable tray system
 - 2. Chatsworth Products “OnTrac” series wire mesh cable tray
 - 3. Cooper B-Line “Flextray” series wire mesh cable tray
 - 4. Cope “Acroba” series wire mesh cable tray
 - 5. Legrand Cablofil wire mesh cable tray
 - 6. Mono-Systems “Mono-Mesh” wire mesh cable tray
 - 7. MP Husky “Techtray” wire mesh cable tray
 - 8. WMT
 - 9. Or equal

2.2 CABLE TRAY – “REDI-RAIL” (LADDER TYPE) FOR IDF ROOMS

- A. Application: Suitable for indoor installation to support and manage communications (and other low voltage) cables, overhead in telecommunications (or equipment) rooms, in accordance with the CEC Article 392.
- B. Classification: NEMA VE1, Class 12B ladder type tray.
- C. Listing: Cable tray shall be UL-classified as a grounding conductor. Cable tray shall be listed by a nationally recognized testing laboratory, and shall bear the UL label. Markings shall be permanent.
- D. Material: Extruded parts, including straight section side rails, fitting side rails, rungs and splice plates, shall be made from Aluminum Association Alloy 6063. Fabricated parts shall be made from Aluminum Association Alloy 5052.
- E. Finish: Natural finish aluminum (primarily 6063-T6 alloy)
- F. Rung Spacing: 9 inches
- G. Size: As indicated on Drawings
 - 1. Overall Width: 18 inches
 - 2. Overall Height: 4 inches
 - 3. Fitting Radius: 12 inches (305 mm) or greater
- H. Splicing assemblies shall be the bolted type using serrated flange locknuts.
- I. Manufacturers:
 - 1. Cooper B-Line “Redi-Rail” series aluminum ladder type cable tray
 - 2. No known equal

2.3 CABLE TRAY – “REDI-RAIL” (RUNWAY TYPE) FOR IDF ROOMS

- A. Application: Suitable for indoor installation to support and manage communications (and other low voltage) cables, generally overhead in telecommunications rooms.
- B. Listing: Cable tray shall be UL-classified as a grounding conductor. Cable tray shall be listed by a nationally recognized testing laboratory, and shall bear the UL label. Markings shall be permanent.
- C. Material: Extruded parts, including straight section side rails, fitting side rails, rungs and splice plates, shall be made from Aluminum.
- D. Finish: Natural finish aluminum
- E. Rung Spacing: 9 inches (229 mm)
- F. Size: As indicated on Drawings
- G. Manufacturers:
 - 1. Cooper B-Line “Redi-Rail” Runway series aluminum ladder type cable runway
 - a. #SB13AL12; straight section, 1.5”H x 12”W x 10’L, 9” rungs
 - b. #SB2107BZ; 1.5”H Cable Runway Butt-Splice Clamp
 - c. #9ZN-R238; 3/8” Hanger Rod Bracket
 - d. #9ZN-R220; 1/2” Hanger Rod Bracket

- e. #SB13ALDO12FB; Drop Out
 - f. #SB227R6FB; 6" Runway Standoff Bracket, two-post rack
 - g. #SB227E6FB; 6" Runway Standoff Bracket, enclosure cabinet
2. Cooper B-Line Cable Runway (for support of Redi-Rail Runway above)
- a. #SB2101ABZ; 90-degree junction splice kit, black
 - b. #SB21312KFB; triangle support kit for 9" - 12" wide cable runway, black
 - c. #SB213312FB; rack-to-runway attachment kit, for 9" - 12" wide runway, black
 - d. #SB211312FB; runway wall angle support kit, for 12" wide runway, black

PART 3 Execution

3.1 GENERAL

- A. Comply with the Execution requirements of Section 270000.
- B. Install cable tray systems in accordance with manufacturers' instructions, with NEMA VE2 and with recognized industry practices, Install cable tray systems compliant to requirements of CEC, applicable portions of NFPA 70B, and to NECA's "Standards of Installation" pertaining to general electrical installation practices.

3.2 PREPARATION

- A. Plan routes and locations of pathway systems and coordinate with other trades/systems (ductwork, plumbing, electrical raceways, wall construction, ceilings, etc.). Pathway systems shall not unnecessarily cross other trade's work, shall not prevent removal of ceiling tiles or panels, and shall not block access to mechanical or electrical equipment. Provide offsets as required to avoid obstruction of pathway systems with other trades.
- B. Prior to installation, examine areas to receive pathways systems to verify conditions are ready for work and to verify conformance with manufacturer and specification tolerances. Notify the Owner's Representative in writing of conditions that would adversely affect the installation, or subsequent utilization, of the system. Proceed with installation when unsatisfactory conditions are corrected.

3.3 INSTALLATION

- A. Do not anchor supports from ductwork, piping, or other equipment hangers. Attach supports to the exterior of the cable tray. Do not install brackets, rods, etc., through the inside of the cable tray
- B. Ensure no other trades/building systems conflict with cable tray systems and clearances. Other building infrastructure, such as columns, pipes, valves, etc., shall not route inside or through cable tray. Either relocate/alter other building infrastructure (preferred) or, if other building infrastructure cannot be altered, adjust the cable tray route to avoid conflicts other building infrastructure.
- C. Install cable trays parallel or at right angles to the centerlines of columns and beams.
- D. Round edges and smooth surfaces to eliminate sharp edges and spurs that could damage (cut, puncture, etc) cable jackets.
- E. Thoroughly clean surfaces receiving connections for bonding.

- F. Clearances: Ensure clearance and access requirements to cable tray – above, below, and side – as shown on the drawings are met. Coordinate with other trades to avoid other building infrastructure encroaching on access/clearance.
- G. Fabricate fittings (tee, cross, reducers, and 90-degree turns) in the field according to the manufacturer's instructions and to ensure the pathway system remains UL listed. Fabricate fittings by cutting wires with a cutting device approved by the manufacturer. Cut wires in a manner that minimizes sharp edges and projections to prevent damage to cables (such as cut outer jacket) or harm to installation personnel. Provide corner connectors that provide a radius on the inside corner of bends for horizontal 90 degree bends, tees, and crosses. Bends shall have a minimum of a 12-inch bend radius.
- H. At transition to and/or interface with conduit, align end of cable tray directly underneath the conduits.
- I. Bonding and Grounding
 - 1. Bond system per "System Description" requirements.
 - 2. For aluminum cable tray, apply anti-oxidant compound to tray surface before contact with bonding accessories.
- J. Protection: Protect installed system until completion of project. Touch-up, repair or replace damaged products before punch walk.

3.4 PRE-FUNCTIONAL TESTING

- A. After installing cable tray systems, perform the following pre-functional testing.
- B. Visually inspect the completed cable tray system for intrusion of items such as pipe, hangers, or other equipment. If found, notify Engineer (explain in detail the conflict and suggest means to eliminate the conflict). Adjust cable tray as approved to eliminate spatial conflict and to ensure clearance.
- C. Visually inspect the completed cable tray system for mechanical continuity at each cable tray joint, fitting, junction, attachment to supports (e.g., hold-down clips), etc. Check the hardware for missing or damaged bolts, bolt heads, or nuts – if found, replace with specified hardware. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
- D. Visually inspect seismic bracing. Ensure each instance complies with approved methods and is complete (anchors, stiffeners, hardware, etc). Check the hardware for missing or damaged bolts, bolt heads, or nuts – if found, replace with specified hardware. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
- E. Visually inspect the barriers to ensure they have been installed per dimensions specified
- F. Visually inspect the cover to ensure they have been installed as require
- G. Visually inspect the completed cable tray system for vibration. If excessive vibration is found, provide vibration isolation apparatus as needed to eliminate vibration.
- H. Visually inspect the completed cable tray system for thermal expansion and contraction conditions. If thermal expansion is identified, provide expansion fittings and other apparatus necessary to eliminate (or mitigate) expansion (and/or contraction).
- I. Visually inspect the completed cable tray system for electrical continuity at each cable tray joint and each ground connection. Ensure adequacy of cable tray grounding. Verify that takeoff raceways are bonded to cable tray.

- J. Visually inspect the completed cable tray system for sharp edges and corners. If found, grind or file edges and corners to smooth.
- K. Visually inspect the completed cable tray system for deflections and protuberances; correct any not within specifications
- L. Clean cable tray system: Remove deposits of dust, scrap materials, trash of any description, and any blockage of tray ventilation.
- M. Record results of visual inspections. Submit pre-functional report to Engineer.

3.5 TESTING

- A. Test cable tray systems in accordance with NFPA 70B Chapter 21 for electrical continuity and connection to approved ground. Measure ground resistance; verify cable tray is bonded to approved ground with a total resistance less than 5 ohms. Adjust bonding as needed to meet this requirement.

3.6 PROTECTION

- A. Protect installed products until completion of project.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
 - 2. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.
 - 3. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.7 FINAL INSPECTION AND CERTIFICATION

- A. Punch the work of this section compliant to the requirements of Section 270000.
- B. Comply with system acceptance and certification requirements of Section 270000.

END OF SECTION