Specifier Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) 3-Part Format as described in *MasterFormat® 2020 Edition.*

This section should be carefully reviewed and edited by the Architect or Engineer to meet the requirements of the project and local building code. Coordinate this section with other specification sections and the Drawings. Delete any information and specifier notes below in Parts 1, 2 or 3 which are not required or relevant for the project.

Section numbers are from *MasterFormat 2020 Edition.*

**SECTION 26 05 36**

**CABLE TRAYS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

* 1. **SCOPE**
		1. This section includes:
			1. Metal cable trays
			2. Nonmetallic cable trays
			3. Cable tray accessories
		2. 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.
		3. Products Installed, but Not Furnished, under This Section:
			1. Section 078413 "Penetration Firestopping" specifies firestopping products installed under this Section
			2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding products installed under this Section.
			3. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
	2. **action submittals**

Action submittals are submittals requiring responsive action and return of reviewed documents to Contractor.

* + 1. Product Datasheets
			1. Metal cable trays.
			2. Nonmetallic cable trays.
			3. Cable tray accessories.
		2. Shop Drawings
			1. Cable tray fabrication drawings, diagrams, and supporting documents.
		3. Field quality-control reports
	1. **INFORMATIONAL SUBMITTALS**

Informational submittals are submittals that require review by Architect/Engineer, but they do not require Architect's/Engineer’s responsive action and return of reviewed documents to Contractor, provided submittals comply with requirements. If rejected, submittals with responsive action must be returned to the Contractor.

* + 1. Manufacturers' published installation instructions
		2. Field reports
			1. Factory test reports.
			2. Manufacturer's field reports for field quality-control support.
1. **PRODUCTS**
	1. **manufacturers**
		1. Basis of Design – Preferred Manufacturer:

The list of manufacturers below does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed below are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not listed will be considered only if pre-approved by the engineer

* + 1. Preferred Manufacturers: Subject to compliance with these specification requirements, provide products by the following
			1. Eaton B-Line series
			2. Engineer-approved equal
	1. **METAL CABLE TRAYS**
		1. Description: This product category covers metal cable trays and metal cable tray systems intended for field assembly and for use in accordance with Article 392 of NFPA 70.

Eaton offers several options for metallic cable tray including galvanized steel, stainless steel and aluminum. Eaton ladder type cable tray is available in a heavy duty (Series 2, 3, 4 and 5) and a light duty NEMA 12A/12B (KwikRail) option.

Eaton wire basket cable tray called Flextray is also included in this section.

* + 1. Performance Criteria:
			1. Regulatory requirements:
				1. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
			2. Listing Criteria:
				1. UL CCN CYNW; including NEMA VE 1 and suitability for use as equipment grounding conductors in accordance with Sections 392.60(A) and 392.60(B) of NFPA 70.

Copy and revise first paragraph below for each configuration indicated on the design Drawings.

Insert drawing designation. Use these designations on Drawings to identify each product.

* + 1. UL CYNW – Ladder Cable Tray

Eaton B-Line Series 2, 3, 4 and 5 cable tray

* + - 1. Source limitations: Obtain products from single manufacturer
			2. General characteristics:
				1. Provide cable trays of the types, classes and sizes indicated with splice plates, bolts, nuts and washers for connecting units as a complete assembly.
				2. Configuration: Two longitudinal side rails with transverse rungs welded to side rails, complying with NEMA VE 1.
				3. Straight Section Rung Spacing: Rungs shall be spaced **[6] [9] [12]** inches apart.
				4. Radius-Fitting Rung Spacing: **9 inch** at center of tray's width.
				5. Minimum Cable-Bearing Surface for Rungs: **7/8 inch** width with radius edges.
				6. No portion of the rungs must protrude below the bottom plane of side rails.
				7. Splicing Assemblies: Bolted type using serrated flange locknuts.
				8. Splice-Plate Capacity: Splice plates shall be manufactured of high strength steel, meeting the minimum mechanical properties of ASTM A1011 HSLAS, Grade 50, Class 1 and be secured with 8 nuts and bolts per plate.

The resistance of fixed splice connections between an adjacent section of tray shall not exceed **0.00033 ohm**.

Note: Eaton’s wedge lock 4 bolt splice connections or KwikRail 2 bolt splice connections are UL classified as an equipment ground conductor.

* + - * 1. Cable tray loading depth shall be **[3] [4] [5] [6]** inches per NEMA VE 1.
				2. Straight sections shall have side rails fabricated as I-beams. Straight sections shall be supplied in standard **[12 foot] [24 foot] [10 foot (3 m)] [20 foot (6 m)] [30 feet]** or **[40 feet]** lengths.
				3. Cable tray widths shall be **[6] [9] [12] [18] [24] [30] [36]** inches or as shown on drawings.
				4. All fittings must have a minimum radius of **[12] [24] [36] [48]** inches.
				5. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a **200 lb**. concentrated load, when tested in accordance with NEMA VE 1.
				6. Cable tray shall be capable of carrying a uniformly distributed load of \_\_\_\_\_\_ lbs./ft. on a \_\_\_\_\_\_\_ ft. support span with a safety factor of 1.5 when supported as a simple span and tested per NEMAVE 1 5.2. In addition to the uniformly distributed load the cable tray shall support 200 lbs. concentrated load at mid-point of span. Load and safety factors specified are applicable to both the side rails and rung capacities. Cable tray shall be made to manufacturing tolerances as specified by NEMA.
				7. Upon request, manufacturer shall provide test reports in accordance with the latest revision of NEMA VE 1 or CSA C22.2 No. 126.

Retain one or more of "Materials and Finishes (Steel)," "Materials and Finishes (Aluminum)," "Materials and Finishes (Stainless Steel)" subparagraphs below. If using more than one type of cable tray material for the Project, consider using a schedule to detail the specific requirements in each area. See "Cable Tray Materials" Article in the Evaluations.

* + - 1. Materials and Finishes (Steel):
				1. Straight Section, Fitting Side Rails, Rungs and Covers: shall be structural steel that complies with the minimum mechanical properties of **[ASTM A1011/A1011M, SS, Grade 33] [ASTM A1008/A1008M, Grade 33, Type 2]**.
				2. Steel Tray Splice Plates: ASTM A1011/A1011M, HSLAS, Grade 50, Class 1.
				3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A510/A510M, Grade 1008.
				4. Finish:

Retain one of first six subparagraphs below or insert a different finish. Retain one option in first subparagraph below

Pre-galvanized Steel: complying with ASTM A653 SS, Grade 33, coating designation G90. Hardware finish shall be electrogalvanized zinc per ASTM B633

Hot-dip galvanized after fabrication: complying with ASTM **[A1011 SS, Grade 33 for 14 gauge and heavier] [ASTM A1008, Grade 33 Type 2 for 16 gauge and lighter]** and shall be hot dip galvanized after fabrication in accordance with ASTM A123. Mill galvanized covers are not acceptable for hot dip galvanized cable tray. Hardware finish shall be chromium zinc per ASTM F-1136-88.

* + - 1. Materials and Finishes (Aluminum):
				1. Materials: Materials: Alloy 6063-T6 in accordance with ANSI H35.1/H 35.1M for extruded components, and **[Alloy 5052-H32] [Alloy 6061-T6]** in accordance with ANSI H35.1/H 35.1M for fabricated parts.
				2. Hardware: **[Chromium-zinc-plated steel, ASTM F1136] [Stainless steel, Type 316, ASTM F593 and ASTM F594]**.
				3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F593 and ASTM F594.
			2. Materials and Finishes (Stainless Steel):
				1. Materials: Low-carbon, passivated stainless steel, **[Type 304L] [Type 316L]**, ASTM F593 and ASTM F594.
				2. Hardware for Stainless Steel Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F593 and ASTM F594.
				3. Class Designation: Comply with NEMA VE 1, **[Class 5AA] [Class 5A] [Class 8AA] [Class 8A] [Class 10AA] [Class 10A] [Class 12A] [Class 20A]**.
				4. Covers: **[Solid] [Louvered] [Ventilated-hat] [2-in-3 pitch]** type made of same materials and with same finishes as cable tray.
		1. UL CYNW – Ladder Cable Tray

Eaton KwikRail cable tray is available in ladder, vented bottom and solid bottom options (solid bottom only available on welded fabrication) and is for light duty use only.

* + - 1. Source limitations: Obtain products from single manufacturer
			2. General characteristics:
				1. Provide cable trays of the types, classes and sizes indicated with splice plates, bolts, nuts and washers for connecting units as a complete assembly.
				2. Configuration: Two longitudinal side rails with transverse rungs mechanically fastened/bolted or welded to side rails with the option to add mechanically fastened rungs at any point along the longitudinal members. Tray shall comply with NEMA VE 1.
				3. Straight Section Rung Spacing: Rungs shall be spaced **[6] [9] [12]** inches apart.
				4. Radius-Fitting Rung Spacing: **9 inch** at center of tray's width. Mechanically fastened rungs shall be capable of easy removal, reinstallation or replacement as necessary.
				5. Ventilated Bottom Cable Tray shall have rung spacing at **6 inch** apart.
				6. Solid Bottom Cable Tray shall have a solid sheet over rungs spaced **12 inch** on center.
				7. Minimum Cable-Bearing Surface for Rungs: **7/8 inch** width with radius edges.
				8. No portion of the rungs must protrude below the bottom plane of side rails.
				9. Splicing Assemblies: 4 bolt or 2 bolt splice plate type using serrated flange locknuts. Eaton’s wedge lock 4 bolt splice connections or KwikRail 2 bolt splice connections are UL classified as an equipment ground conductor.

KwikRail 2 bolt splice connections are UL classified as an equipment ground conductor.

* + - * 1. Splice-Plate Capacity: Splice plates shall be manufactured of high strength steel, meeting the minimum mechanical properties of ASTM A1011 HSLAS, Grade 50, Class 1 and be secured with 8 nuts and bolts per plate. The resistance of fixed splice connections between an adjacent section of tray shall not exceed 0.00033 ohm.
				2. Cable tray loading depth shall be **[3] [4] [5]** **[6]** inches per NEMA VE 1.
				3. Straight sections shall have side rails fabricated as I-beams. Straight sections shall be supplied in standard **[10 foot (3 m)] [12 foot (3.65 m) ][ 20 foot]** **[30 foot]** lengths.
				4. Cable tray widths shall be **[6] [9] [12] [18] [24] [30] [36]** inches or as shown on drawings.
				5. All fittings must have a minimum radius of **[12] [24] [36] [48]** inches.
				6. Splice plates shall have (2) nuts and bolts per plate. The resistance of fixed splice connections between adjacent sections of tray shall not exceed **0.00033 ohms**. Splice plates shall be furnished with all straight sections and fittings.
				7. All fittings shall have an inside radius of **[12] [24]** inches.
				8. Loading Capacities: Cable tray shall meet NEMA class designation: **[NEMA 12A: 50 lbs/ft on 12 foot span] [NEMA 12B: 75 lbs/ft on 12 foot span]** **[Class 12C] [Class 20A] [Class 20B] [Class 20C]**
				9. OR Cable tray shall be capable of carrying a uniformly distributed load of \_\_\_\_\_\_ lbs./ft. on a \_\_\_\_\_\_\_ ft. support span with a safety factor of 1.5 when supported as a simple span and tested per NEMAVE 1 5.2.

Retain one or more of "Materials and Finishes (Steel)," "Materials and Finishes (Aluminum)," and "Materials and Finishes (Stainless Steel)" subparagraphs below. If using more than one type of cable tray material for the Project, consider using a schedule to detail the specific requirements in each area. See "Cable Tray Materials" Article in the Evaluations.

* + - 1. Materials and Finishes (Steel):
				1. Straight Section, Fitting Side Rails, Rungs and splice plates: shall be Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.
				2. Steel Tray Splice Plates: ASTM A1011/A1011M, HSLAS, Grade 50, Class 1.
				3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A510/A510M, Grade 1008.
				4. Finish:

Retain one of first six subparagraphs below or insert a different finish.

Pre-Galvanized Steel: complying with ASTM A653 SS, Grade 33, coating designation G90. Hardware finish shall be electrogalvanized zinc per ASTM B633.

Hot-dip galvanized after fabrication, complying with ASTM **[A1011 SS, Grade 33 for 14 gauge and heavier] [ASTM A1008, Grade 33 Type 2 for 16 gauge and lighter]** and shall be hot dip galvanized after fabrication in accordance with ASTM A123. Mill galvanized covers are not acceptable for hot dip galvanized cable tray. Hardware finish shall be chromium zinc per ASTM F-1136-88.

**[Epoxy-resin] [Powder-coat enamel]** paint, with **[chromium-zinc plated, ASTM F1136] [stainless steel, Type 316, ASTM F593 and ASTM F594]** hardware.

Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment, with factory-applied powder-coat paint.

Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.

Epoxy-Resin Topcoat: Epoxy, cold-cured gloss, MPI# 77.

Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware in accordance with ASTM F1136.

Black oxide finish for support accessories and miscellaneous hardware in accordance with ASTM D769.

* + - 1. Materials and Finishes (Aluminum):
				1. Materials: Alloy 6063-T6 in accordance with ANSI H35.1/H 35.1M for extruded components, and **[Alloy 5052-H32] [Alloy 6061-T6]** in accordance with ANSI H35.1/H 35.1M for fabricated parts.
				2. Hardware: **[Chromium-zinc-plated steel, ASTM F1136] [Stainless steel, Type 316, ASTM F593 and ASTM F594]**.
				3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F593 and ASTM F594.
			2. Materials and Finishes (Stainless Steel):
				1. Materials: Low-carbon, passivated stainless steel, **[Type 304L] [Type 316L]**, ASTM F593 and ASTM F594.
				2. Hardware for Stainless Steel Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F593 and ASTM F594.

Maximum uniform load and support span are indicated by cable tray class. See "Load/Span Classification System" Article in the Evaluations.

* + - * 1. Class Designation: Comply with NEMA VE 1, **[Class 12A] [Class 12C] [Class 20A] [Class 20B] [Class 20C]**
				2. Covers: **[Solid] [Louvered] [Ventilated-hat] [2-in-3 pitch]** type made of same materials and with same finishes as cable tray.

Insert drawing designation. Use these designations on Drawings to identify each product.

* + 1. UL CYNW – Wire Mesh Cable Tray

Eaton Flextray is a wire basket tray for use with communications and fiber optic cable systems. The Flextray™ system is a flexible, field-adaptable way to manage cables throughout the project. The tray can be cut and bent to the needs of the installer on the jobsite, allowing cable runs to be adjusted as needed. Flextray has a “T” weld safety edge, protecting both the cable and the installer during cable installation. Flextray is also UL Classified as an equipment grounding conductor.

* + - 1. Source limitations: Obtain products from single manufacturer
			2. General characteristics:
				1. Configuration: Galvanized-steel wire mesh, complying with NEMA VE 1.
				2. Structural Performance: Flextray fill capacity is based on NEC allowable fill of 50%. The NEC rule requires that the cable cross-sectional areas together may not exceed 50% of the tray area (width x depth = fill). Cables will nearly completely fill the cable tray when reaching the 50% cable fil
				3. Splicing Assemblies: Washer splice kit, wing splice, Flexmate (BAA compliant), Tab-Loc Connector, Splice bar kit, or equivalent splice method utilizing designated number of splices required for UL Classification
			3. Materials and Finishes (Steel):

ASTM A1011/A1011M is for 14 gage and thicker; ASTM A1008/A1008M is for 16 gage and thinner. Both have structural-steel (SS) and high-strength, low-alloy-steel (HSLAS) designations.

* + - * 1. Straight Sections and Fittings: Steel complies with the minimum mechanical properties of **[ASTM A1011/A1011M, SS, Grade 33] [ASTM A1008/A1008M, Grade 33, Type 2]**.
				2. Steel Tray Splice Plates: ASTM A1011/A1011M, HSLAS, Grade 50, Class 1.
				3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A510/A510M, Grade 1008.

Retain one of first five subparagraphs below or insert a different finish.

* + - * 1. Finish:

Plain wire: ASTM A510, Grade 1008 EG Electroplated zinc galvanized finish applied after fabrication (ELG) Recommended applications: Controlled interior UL/CSA Classified as an equipment ground conductor when spliced as recommended ASTM B633 - Average thickness of 0.3 mils (8 microns).

GS Pre-galvanized zinc finish applied before fabrication (GLV) UL/CSA Classified as an equipment ground conductor when spliced as recommended ASTM A641

Black powder coat finish UL/CSA Classified as an equipment ground conductor when coating has been removed at splice contact points Average paint thickness of 1.2 mils (30 microns) to 3.0 mils (75 microns).

HD Hot dip galvanized finish applied after fabrication (HDG). UL/CSA Classified as an equipment ground conductor when spliced as recommended ASTM A123 - Average thickness of 2.4 mils (60 microns) to 3.2 mils (80 microns)

Hot-dip galvanized after fabrication, complying with ASTM A123/A123M, Class B2, with **[galvanized, ASTM B633] [chromium-zinc plated, ASTM F1136][stainless steel, Type 316]** hardware.

* + - * 1. Width: **[2 inch] [4 inch] [6 inch] [8 inch] [12 inch] [16 inch] [18 inch] [20 inch] [24 inch]** unless otherwise indicated on Drawings.
				2. Minimum Usable Load Depth: **[2 inch] [4 inch] [6 inch]**.
				3. Straight Section Lengths: 10 ft except where shorter lengths are required to facilitate tray assembly.

Insert drawing designation. Use these designations on Drawings to identify each product.

Eaton’s solid bottom tray has a flat sheet of metal welded on top of 12” spaced rungs.

* + 1. UL CYNW – Solid-Bottom Cable Tray
			1. Source limitations: Obtain products from single manufacturer
			2. General characteristics:
				1. Configuration: Two longitudinal side rails with a nonventilated continuous bottom. Solid bottom has a flat sheet of metal welded on top of 12”-spaced rungs
				2. No portion of the continuous bottom must protrude below the bottom plane of side rails.
				3. Structural Performance: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200 lb. concentrated load, when tested in accordance with NEMA VE 1.
				4. Splicing Assemblies: Bolted type using serrated flange locknuts.
				5. Splice-Plate Capacity: Splices located within support spans must not diminish rated loading capacity of cable tray.

Retain one or more of "Materials and Finishes (Steel)," "Materials and Finishes (Aluminum)," and "Materials and Finishes (Stainless Steel)" subparagraphs below. If using more than one type of cable tray material for the Project, consider using a schedule to detail the specific requirements in each area. See "Cable Tray Materials" Article in the Evaluations.

* + - 1. Materials and Finishes (Steel):

ASTM A1011/A1011M is for 14 gage and thicker; ASTM A1008/A1008M is for 16 gage and thinner. Both have structural-steel (SS) and high-strength, low-alloy-steel (HSLAS) designations.

* + - * 1. Straight Sections and Fittings: Steel complies with the minimum mechanical properties of **[ASTM A1011/A1011M, SS, Grade 33] [ASTM A1008/A1008M, Grade 33, Type 2]**.
				2. Steel Tray Splice Plates: ASTM A1011/A1011M, HSLAS, Grade 50, Class 1.
				3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A510/A510M, Grade 1008.
				4. Finish:

Retain one of first six subparagraphs below or insert a different finish. Retain one option in first subparagraph below.

Mill galvanized before fabrication complying with ASTM A653/A653M, G90, with **[galvanized, ASTM B633] [chromium-zinc plated, ASTM F1136]** hardware.

Electrogalvanized before fabrication, complying with ASTM B633, with galvanized, ASTM B633 hardware.

Retain one option in first subparagraph below.

Hot-dip galvanized after fabrication complying with ASTM A123/A123M, Class B2, with **[chromium-zinc plated, ASTM F1136] [stainless steel, Type 316]** hardware.

Retain one of last two options in first subparagraph below.

**[Epoxy-resin] [Powder-coat enamel]** paint, with **[chromium-zinc plated, ASTM F1136] [stainless steel, Type 316, ASTM F593 and ASTM F594]** hardware.

Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment, with factory-applied powder-coat paint.

Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.

Epoxy-Resin Topcoat: Cold-cured epoxy gloss, MPI# 77.

Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware in accordance with ASTM F1136.

Black oxide finish for support accessories and miscellaneous hardware in accordance with ASTM D769.

* + - 1. Materials and Finishes (Aluminum):
				1. Materials: Alloy 6063-T6 in accordance with ANSI H35.1/H 35.1M for extruded components, and **[Alloy 5052-H32] [Alloy 6061-T6]** in accordance with ANSI H35.1/H 35.1M for fabricated parts.
				2. Hardware: **[Chromium-zinc-plated steel, ASTM F1136] [Stainless steel, Type 316, ASTM F593 and ASTM F594]**.
				3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F593 and ASTM F594.
			2. Materials and Finishes (Stainless Steel):
				1. Materials: Low-carbon, passivated stainless steel, **[Type 304L] [Type 316L]**, ASTM F593 and ASTM F594.
				2. Hardware for Stainless Steel Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F593 and ASTM F594.
			3. Options:
				1. Width: **[6 inch] [9 inch] [12 inch] [18 inch] [24 inch] [30 inch] [36 inch]** unless otherwise indicated on Drawings.
				2. Minimum Usable Load Depth: **[3 inch] [4 inch] [5 inch] [6 inch]**.
				3. Straight Section Lengths: **[10 ft] [12 ft] [20 ft] [24 ft]**, except where shorter lengths are required to facilitate tray assembly.
				4. Fitting Minimum Radius: **[12 inch] [24 inch] [36 inch] [48 inch]**.

Maximum uniform load and support span are indicated by cable tray class.

* + - * 1. Class Designation: Comply with NEMA VE 1, **[Class 5AA] [Class 5A] [Class 8AA] [Class 8A] [Class 10AA] [Class 10A] [Class 12AA] [Class 12A] [Class 20AA] [Class 20A] <Insert designation>**.
				2. Covers: **[Solid][Louvered][Ventilated-hat] [2-in-3 pitch]** type made of same materials and with same finishes as cable tray.

Insert drawing designation. Use these designations on Drawings to identify each product.

* + 1. UL CYNW – Channel Cable Tray

The KwikSplice cable channel is a dove tail side rail design with a guided splice plate system. The system can be cut and spliced at any point along the tray. Pressure-fit connection splice plates are UL Classified as equipment grounding conductor. Fittings come with splice plates pre-installed.

* + - 1. Source limitations: Obtain products from single manufacturer
			2. General Characteristics:
				1. Cable channel straight sections shall consist of a singularly extruded channel shaped body that includes dove tail openings on each channel upright for the explicit purposes of:

Accommodation field cuts at any point on the section of the cable channel without the need for additional modification, splices, hardware and/or labor.

Attachment of splices, fittings and/or accessories in the creation of the desired cable channel system.

* + - * 1. Ventilated Cable Channel: The cable channel shall have a post-punched pattern on the underside of the profile consistent with one of the following:

 Retain one of the two following paragraphs.

Ventilated cable channel with pass through holes: a repeating uniform perforated patten with 2.25 inch diameter cable pass through holes every 12 inches.

Ventilating cable channel: a repeating uniform perforated pattern for ventilation every 6 inches without pass through holes.

* + - * 1. Non-Ventilated Cable Channel (solid bottom): Kwiksplice Cable Channel
				2. Structural Performance: Cable channel shall be capable of carrying a uniform distributed load of 4 lbs/ft on a 20 foot support span with a safety factor of 1.5 when supported as a simple span and tested per NEMA VE 1, section 5.2.
				3. Splicing Assemblies: Dove tail locking design with pressure fit connection. UL Classified as equipment grounding conductor
				4. Splicing Assembly Capacity: Splices located within support span must not diminish rated loading capacity of cable tray.
				5. Configuration: Single, formed sheet with a **[solid] [ventilated]** bearing surface, complying with NEMA VE 1.
				6. Width: **[2 inch] [4 inch] [6 inch]** unless otherwise indicated on Drawings.
				7. Minimum Usable Load Depth: 2 inch.
				8. Straight Section Lengths: **[10 ft (3m)] [12 ft (4m)] [20 ft (6m)]** except where shorter lengths are required to facilitate tray assembly.

Straight sections shall include pre-assembled splices and hardware. Splices and hardware can be pre-installed upon request.

The engineer can request pre-installed splices and hardware in the specification.

* + - * 1. Fitting Minimum Radius: **[12 inch] [24 inch]**.
				2. Splices: Splices shall be universally compatible for all cable channel widths. They shall be pre-assembled and ready for immediate field installation.

The resistance of fixed splice connectors between adjacent sections of cable channel shall not exceed. 0.00033 ohms.

* + - * 1. Fittings shall be pre-installed with splices.

Eaton offers Kwiksplice Cable Channel in aluminum only. Eaton offers ACC or PCC channel in aluminum, Type 1-HDG, Type 2-Pre Galv, SS4 304 Stainless Steel, SS6 316 Stainless Steel

* + - 1. Materials and Finishes (Aluminum):
				1. Materials: Extruded components shall be made from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.
				2. Hardware: **[Chromium-zinc-plated steel, ASTM F1136] [Stainless steel, Type 316, ASTM F593 and ASTM F594]**.
				3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F593 and ASTM F594.

Maximum uniform load and support span are indicated by cable tray class. See "Load/Span Classification System" Article in the Evaluations.

* + - * 1. Class Designation: Comply with NEMA VE 1
				2. Covers: **[Solid] [Louvered] [Ventilated-hat] [2-in-3 pitch]** type made of same materials and with same finishes as cable tray.
	1. **NONMETALLIC CABLE TRAYS**
		1. UL CYOV – Fiberglass Cable Tray
			1. Source Limitations: Obtain products from single manufacturer.
			2. General Characteristics:
				1. Configuration: Two longitudinal members with rounded edges and smooth surfaces, supporting a bearing surface, complying with NEMA FG 1.

See "Load/Span Classification System" Article in the Evaluations for discussion of temperature effects.

* + - * 1. Temperature Rating: Reduce the load rating of trays exposed to temperatures above **75 deg F** in accordance with Table 4-3, "Working Loads," in NEMA FG 1.
				2. Splicing Assemblies: Minimum four nuts and bolts per plate. Splice plates must be furnished with straight sections and fittings.
				3. Splicing Assembly Capacity: Splices located within support span must not diminish rated loading capacity of cable tray.
				4. Fasteners: Fiberglass-encapsulated, ASTM F593 and ASTM F594 stainless steel, Type 316. Design fasteners so that no metal is visible when fully assembled and tightened. Fastener encapsulation must not be damaged when torqued to manufacturer's recommended value.
			1. Options:
				1. Materials: Straight section structural elements; side rails, rungs, and splice plates must be pultruded from glass-fiber-reinforced [polyester] [vinyl ester] resin, complying with NEMA FG 1 and UL 568.
				2. Width: **[6 inch] [9 inch] [12 inch] [18 inch] [24 inch] [30 inch] [36 inch]** unless otherwise indicated on Drawings.
				3. Minimum Usable Load Depth: **[1 inch] [2 inch] [3 inch] [5 inch] [7 inch]** in accordance with NEMA FG 1.
				4. Straight Section Lengths: **[10 ft] [20 ft]**.

Maximum uniform load and support span are indicated by cable tray class.

* + - * 1. Class Designation: Comply with NEMA VE 1,NEMA 12C, 20A, 20C
				2. Fitting Minimum Radius: **[12 inch] [24 inch] [36 inch]**
				3. Covers: **[Solid] [Louvered] [Ventilated-hat] [2-in-3 pitch]** type made of same materials and with same finishes as cable tray.

Insert drawing designation. Use these designations on Drawings to identify each product.

* + 1. UL CYOV – Fiberglass Channel Cable Tray
			1. Source Limitations: Obtain products from single manufacturer.
			2. General Characteristics:

See "Load/Span Classification System" Article in the Evaluations for discussion of temperature effects.

* + - * 1. Temperature Rating: Reduce the load rating of trays exposed to temperatures above 75 deg F in accordance with Table 4-3, "Working Loads," in NEMA FG 1.
				2. Splicing Assemblies: Minimum four nuts and bolts per plate. Splice plates must be furnished with straight sections and fittings.
				3. Splicing Assembly Capacity: Splices located within support span must not diminish rated loading capacity of cable tray.
				4. Fasteners: Fiberglass-encapsulated, ASTM F593 and ASTM F594 stainless steel, Type 316. Design fasteners so that no metal is visible when fully assembled and tightened. Fastener encapsulation must not be damaged when torqued to manufacturer's recommended value.
			1. Options:
				1. Configuration: Two longitudinal members with rounded edges and smooth surfaces, supporting a **[solid] [ventilated]** bearing surface, complying with NEMA FG 1.
				2. Materials: Straight section structural elements; side rails, rungs, and splice plates must be pultruded from glass-fiber-reinforced **[polyester] [vinyl ester]** resin, complying with NEMA FG 1 and UL 568.
				3. Width: **[3 inch] [4 inch] [6 inch]** unless otherwise indicated on Drawings.
				4. Minimum Usable Load Depth: **[1-1/4 inch] [2 inch]**.
				5. Straight Section Lengths: **[10 ft] [12 ft]**, except where shorter lengths are required to facilitate tray assembly.

Maximum uniform load and support span are indicated by cable tray class.

* + - * 1. Class Designation: Comply with NEMA VE 1, **[Class 5AA] [Class 5A] [Class 8AA] [Class 8A] [Class 10AA] [Class 10A] [Class 12AA] [Class 12A] [Class 20AA] [Class 20A].**
				2. Fitting Minimum Radius: **[12 inch] [24 inch]**.
				3. Covers: **[Solid] [Louvered] [Ventilated-hat] [2-in-3 pitch]** type made of same materials and with same finishes as cable tray.
	1. **CABLE TRAY ACCESSORIES**

Eaton offers a full array of cable tray accessories

* + 1. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

Indicate required locations for barrier strips on Drawings.

* + 1. Barrier Strips: Same materials and finishes as for cable tray.
		2. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.
	1. **SOURCE QUALITY CONTROL**

Coordinate "Product Data" Paragraph below with "Action Submittals" Article.

* + 1. Product Data: Prepare and submit catalog cuts, brochures, **[diagrams] [schedules]** and performance data illustrating size, physical appearance, and other characteristics of product.
			1. Include data indicating dimensions and finishes for each type of cable tray indicated.

Retain "Manufacturer's Published Instructions" Paragraph below when execution requirements state "in accordance with manufacturer's published instructions," especially if those instructions may require preinstallation review and coordination with Construction Documents to verify constructability and commissioning requirements. Coordinate paragraph with "Informational Submittals" Article.

* + 1. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

Retain "Factory Tests" Paragraph below for factory-assembled products intended for critical applications in remote areas where removal, repair, reinstallation, retesting, and reinspecting are impracticable. Factory tests for other than prototypes are an added cost option and may not be available from some manufacturers. Verify need for requirement with Owner.

* + 1. Factory Tests:

Retain first subparagraph below if Owner wants tests witnessed.

* + - 1. Owner will witness required factory tests. Notify Architect at least 14 days before date of tests and indicate their approximate duration.

Retain "Testing Administrant" Subparagraph below if required. Independent certification may be acceptable to authorities having jurisdiction without further monitoring of plant's quality-control and testing program by Owner. Coordinate with "Qualifications" Article in Section 260010 "Supplemental Requirements for Electrical."

* + - 1. Testing Administrant: **[Owner will engage] [Engage]** qualified electrical testing agency to evaluate cable trays.
			2. Factory Tests and Inspections: Perform the following tests and inspections on cable trays, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction before delivering to site. Affix label with name and date of **[manufacturer's] [qualified electrical testing laboratory's]** certification of system compliance.
				1. Test and inspect cable trays in accordance with **[NEMA FG 1] [NEMA VE 1]**.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

* + - 1. Nonconforming Work:
				1. Equipment that does not pass tests and inspections will be considered defective.
			2. Factory Test Reports: Prepare and submit factory test and inspection reports.
1. **EXECUTION**
	1. **PREPARATION**

Coordinate "Shop Drawings" Paragraph below with "Action Submittals" Article. Shop drawings may include multi-system and interdisciplinary coordination drawings.

* + 1. Shop Drawings: Prepare and submit the following for each cable tray system:
			1. Cable Tray Fabrication Drawings, Diagrams, and Supporting Documents:
				1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
				2. Include load calculations to show that dead and live loads do not exceed manufacturer's rating for tray and its support elements.

Retain subparagraph below if cable tray route coordination drawings are deleted from Section 260010 "Supplemental Requirements for Electrical."

* + - * 1. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

Vertical and horizontal offsets and transitions.

Clearances for access above and to sides of cable trays.

Vertical elevation of cable trays above the floor or bottom of ceiling structure.

* 1. **INSTALLATION OF CABLE TRAYS**

NEMA FG 1 applies to fiberglass cable trays only. NEMA VE 2 applies to all metallic cable trays.

* + 1. Install cable tray and support systems in accordance with **NEMA VE 2**.
		2. Install cable tray as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
		3. Install cable tray, so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
		4. Remove burrs and sharp edges from cable trays.

Retain first paragraph below for aluminum cable trays only.

* + 1. Join aluminum cable tray with splice plates; use four square-neck carriage bolts and locknuts.
		2. Fasten cable tray supports to building structure **[and install seismic restraints]. [Refer to specification section 260548 – Vibration and Seismic Controls For Electrical Systems.]**

Retain first paragraph below if deleting "Delegated Design" Paragraph in "Performance Requirements" Article. Delete below if retaining "Delegated Design" Paragraph.

* + 1. Design fasteners and supports to carry cable tray, cables, and a concentrated load of **200 lb**. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems." **[Comply with seismic-restraint details in accordance with Section 260548.16 "Seismic Controls for Electrical Systems."]**
		2. Place supports, so that spans do not exceed maximum spans on schedules, and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of tray rungs.
		3. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
		4. Support assembly to prevent twisting from eccentric loading.
		5. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
		6. Do not install more than one cable tray splice between supports.

Retain one of first two paragraphs below.

* + 1. Support wire-basket cable trays with **[center support hangers] [trapeze hangers] [wall brackets]**.
		2. Support **[center support hangers] [trapeze hangers]** for wire-basket trays with **[1/4 inch] [3/8 inch]** diameter rods.

Retain first paragraph below if cable trays connect to equipment.

* + 1. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.

Retain first paragraph below if expansion fittings are required.

* + 1. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed recommended dimensions. Space connectors and set gaps in accordance with applicable standard.
		2. Make changes in direction and elevation using manufacturer's recommended fittings.
		3. Make cable tray connections using manufacturer's recommended fittings.
		4. Seal penetrations through fire and smoke barriers.

If cable trays are sized for future cables, specify provisions for penetrations with sleeves through fire-rated partitions or use "repairable" firestop-sealing material. Include this Section's specific firestopping requirements in a schedule developed in Section 078413 "Penetration Firestopping."

* + 1. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
		2. Install cable trays with enough workspace to permit access for installing cables.

Retain first paragraph below if systems are mixed in a single cable tray.

* + 1. Install barriers to separate cables of different systems, such as power, communications, and data processing, or of different insulation levels, such as 600, 5000, and 15 000 V.

See "Cable Tray Covers" Article in the Evaluations.

* + 1. Install permanent covers and cover clamps, if used, after installing cable.
		2. Clamp covers on cable trays installed outdoors with heavy-duty clamps.
		3. Install warning signs in visible locations on or near cable trays after cable tray installation.
	1. **CABLE TRAY GROUNDING**
		1. Ground cable trays in accordance with NFPA 70 unless additional grounding is specified.
		2. Cable trays with electrical power conductors must be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

Verify that cable tray system is specified for grounding and bonding the largest power conductor in the tray. If system is not specified, retain first paragraph below and revise to suit Project.

* + 1. Cable trays with single-conductor power conductors must be bonded together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72 inch intervals. The grounding conductor must be sized in accordance with Article 250 and Article 392 of NFPA 70.
		2. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding-bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.
		3. Bond cable trays to power source for cables contained within with bonding conductors sized in accordance with Article 250 of NFPA 70.
	1. **INSTALLATION OF CABLES**
		1. Install cables only when each cable tray run has been completed and inspected.

Fastening cables on horizontal runs is beyond the requirements of NFPA 70 in most cases. See the Evaluations.

* + 1. Fasten cables on horizontal runs with cable clamps or cable ties. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
		2. Fasten cables on vertical runs to cable trays every **18 inch**.

Length of unsupported cable is dependent on the cable diameter. See "Cable Installations" Article in Evaluations.

* + 1. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure must be no more than **72 inch**.
		2. Tie mineral-insulated cables down every **36 inch** where required to provide a two-hour fire rating and every **72 inch** elsewhere.
		3. In existing construction, remove inactive or dead cables from cable trays.
	1. **FABRICATION OF CONNECTION POINTS**
		1. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
		2. Connect raceways to cable trays in accordance with requirements in NEMA VE 2 and NEMA FG 1.
	2. **INSTALLATION OF CABLE TRAY MARKINGS AND SIGNS**
		1. Trays Containing Cables Operating Over 600 V: Provide hazard markings in accordance with Section 392.18 of NFPA 70 and with NEMA Z535.4.
			1. Legend: "DANGER - HIGH VOLTAGE - KEEP AWAY."
		2. Ladder Cable Trays: Provide warning signs to prevent use as personnel ladder.

Insert different lettering size in "Lettering" Paragraph below to suit 25 ft (7.6 m) viewing distance.

* + - * 1. Lettering: **[1-1/2 inch] <Insert dimension>** high.
				2. Legend: "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."
	1. **FIELD QUALITY CONTROL**
		1. Acceptance Testing Preparation:
			1. **<Insert requirements>.**

Retain first paragraph below to require that field quality-control tests be witnessed. Local ordinance or custom may require that authorities having jurisdiction witness the testing.

* + 1. Field tests and inspections must be witnessed by **[Architect] [Tenant] [authorities having jurisdiction] <Insert names or titles of witnesses>**.

Coordinate "Tests and Inspections" Paragraph below with "Qualifications" and "Field Quality Control" articles in Section 260010 "Supplemental Requirements for Electrical."

* + 1. Tests and Inspections:
			1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
			2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
			3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
			4. Verify that there are no intruding items, such as pipes, hangers, or other equipment, in the cable tray.
			5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
			6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
			7. Check for improperly sized or installed bonding jumpers.
			8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
			9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 Ω.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

* + 1. Nonconforming Work:
			1. Cable tray will be considered defective if it does not pass tests and inspections.
			2. Remove and replace defective units and retest.
		2. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

Retain "Manufacturer Services" Paragraph below if manufacturer's representative is required to support or supervise the administrant specified in Section 260010 "Supplemental Requirements for Electrical" for field tests and inspections performed by Installer or third-party agencies.

Retain "supervise" option in "Manufacturer Services" Paragraph below when third-party tests and inspections must be witnessed and approved by factory-authorized service representative to satisfy special extended-warranty requirements. In some cases, Installer may be factory authorized under warranty provisions to fulfill this role.

* + 1. Manufacturer Services: Engage factory-authorized service representative to **[support] [supervise]** field tests and inspections.
			1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.
	1. **PROTECTION**
		1. Protect installed cable trays and cables.
			1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and must remain in place until the risk of damage is over.
			2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
			3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 260536