Welcome to our new products catalog. For the first time we offer our complete line of Cope cable tray products in a single catalog. This complete catalog is designed for ease of use and to provide the basic information needed to select the proper cable tray system for your needs.

The first section of the catalog provides comprehensive product information, definitions, and technical data needed to select the proper tray. The second section provides industry standards and guidelines for the manufacture and installation of cable tray.

Cope’s I-BEAM™ tray provides a heavy duty welded cable tray for clients requiring I-BEAM side rails. It is perfect for long span locations, heavy loads, and will interface with existing “I” Beam configuration trays.

Cope’s Swaged Ladder tray uses our patented swaging system of rung attachment. This system of attachment provides a very rigid tray without welding that is easy to handle and install. The flange out design provides the maximum access to your cables, even in narrow or divided cable trays.

Cope’s Hat Rung tray provides a flange in alternative for those instances where space is critical. With the flanges turned inward, this tray can be fitted into confined spaces. Slotted rungs provide excellent cable tie down capability.

Cope Trof provides the ultimate in cable support for your small diameter, flexible cable. With 1” ribs located every 2” on center, drooping of cable is virtually eliminated.

Cope Channel provides an excellent support system for those applications where only a few cables are needed. It can also be used for separation of services in ladder or trof trays.

CAT TRAY™ wire basket provides the superior flexibility and ease of installation required by data-com installations. The exclusive Kwik-Latch system speeds cable tray installation.

Centipede™ center hung cable tray offers the exclusive ability to locate supports at any point along the spine of the cable tray without the need for drilling. This provides perfectly vertical supports every time. Cope’s exclusive adjustable rung feature gives the installer the ability to exit cables from the cable tray at a precise location every time. The wall mounted version provides the most compact mounting system limiting the intrusion of valuable working space.

Cope Glas™ fiberglass cable tray provides the answer to many adverse environments. Life cycle costs, long span capability and easy field modification make Cope Glas™ an ideal choice for industrial, chemical, and petro-chemical facilities.

Our customer service team is available to assist with questions about application, installation, and availability of our products.

Thank you for considering Cope for your cable tray requirements.
SECTION 1 – REFERENCED STANDARDS & DEFINITIONS

1.1 REFERENCED STANDARDS
In this publication, reference is made to the standards listed below. Copies are available from the indicated source.

**ANSI/NFPA 70-93 National Electrical Code®**
American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

National Fire Protection Association
1 Batterymarch Park
Quincy, Massachusetts
USA 02169-7471

- **A123** Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, Specifications for
- **A653** General Requirements, Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Specifications for
- **B633** Electrodeposited Coatings of Zinc on Iron and Steel, Specifications for
- **B766** Electrodeposited Coatings of Cadmium, Specification for

**ASTM International**
100 Barr Harbor Drive
PO Box C700
West Conshohocken, PA, 19428-2959

1.2 DEFINITIONS

**Metallic Cable Tray System** – An assembly of cable tray straight sections, fittings, and accessories that forms a rigid structural system to support cables.

**Ladder Cable Tray** – A prefabricated metal structure consisting of two longitudinal side rails connected by individual transverse members.

**Trof Cable Tray** – A prefabricated metal structure consisting of a ventilated bottom pan or rungs* within integral or separate longitudinal side rails.

*The cable tray bottom will have openings sufficient for the passage of air and utilize 75 percent or less of the plan area of the surface to support cables. The maximum distance between cable support surfaces shall not exceed 100 mm (4”) in the direction parallel to the cable tray side rails.

**Solid Bottom Cable Tray** – A prefabricated metal structure consisting of a bottom with no openings within integral or separate longitudinal side rails.

**Straight Section** – A length of cable tray which has no change in direction or size.

**Cable Tray Fitting** – A device which is used to change the direction or size of a cable tray system.

**Cable Tray Connector (Splice Plate)** – A device which joins cable tray straight sections and fittings, or both. The basic types of connectors (splice plates) are:
- Rigid
- Expansion
- Adjustable
- Reducer

**Fasteners** – Screws, nuts, bolts, washers, rivets, pins, and other items used to assemble a cable tray system.

**Horizontal Elbow (Horizontal Bend)** – A cable tray fitting which changes the direction in the same plane. Standard degrees of bend are 90°, 60°, 45°, and 30°.

**Horizontal Tee** – A cable tray fitting which is suitable for joining cable trays in three directions at 90° intervals in the same plane.

**Horizontal Cross** – A cable tray fitting which is suitable for joining cable trays in four directions at 90° intervals in the same plane.

**Vertical Elbow (Vertical Bend)** – A cable tray fitting which changes direction to a different plane. Standard degrees of bend are 90°, 60°, 45°, and 30°.

An inside vertical elbow changes direction upward from the horizontal plane.

An outside vertical elbow changes direction downward from the horizontal plane.

**Vertical Tee** – A cable tray fitting which is suitable for joining cable trays in three different directions at 90° intervals in different planes.

**Reducer (Straight, Right Hand, Left Hand)** – A cable tray fitting which is suitable for joining cable trays of different widths in the same plane.

A straight reducer has two symmetrical offset sides.

A right-hand reducer, when viewed from the large end, has a straight side on the right.

A left-hand reducer, when viewed from the large end, has a straight side on the left.

**Channel Cable Tray** – A prefabricated metal structure formed from one piece of metal and having either a ventilated bottom or solid-bottom. The channel shall not exceed 152 mm (6”) in width.

www.copecabletray.com
**Accessories** — Devices which are used to supplement the function or plane of straight sections and fittings, and include such items as adjustable splices (horizontal and vertical), dropouts, covers, conduit adapters, hold-down devices and dividers.

**Cable Tray Support** — A device which provides adequate means for supporting cable tray sections and fittings.

The basic types of cable tray supports are:
- Cantilever bracket
- Trapeze
- Single rod suspension.

**Cable Tray Support Span** — The distance between the center lines of supports.

**SECTION 2 — MANUFACTURING STANDARDS**

**2.1 MATERIALS**

Cable tray systems shall be made of either corrosion-resistant metal or metal with a corrosion-resistant finish. Aluminum and stainless steel alloys are inherently corrosion-resistant and no finish coating is required in most environments.

**2.2 FINISHES**

**2.2.1** Carbon steel used for cable trays shall be protected against corrosion by one of the following processes:

A. Hot-dip mill galvanized in accordance with ASTM Publication No. A653.*

*Coating designation G90 of ASTM 653 has an average zinc coating weight of 1.25 oz. per square foot (0.381 kg/m²) of steel total coating on both surfaces (1.06 mils or 0.027mm) average thickness per side).

Hot-dip mill galvanized coatings are produced by continuous rolling steel sheets or strips in coils through a bath of molten zinc. The process involves pre-treating the steel to make the surface react readily with molten zinc as the strip moves through the bath at high speeds. During fabrication where sloting, forming, cutting, or welding is performed, the cut edges and heat-affected zone of welding are subject to superficial oxidation. These areas are then protected through electrolytic action of the adjacent zinc surfaces. The coating is smooth, ductile, and adherent.

B. Hot-dip galvanized after fabrication in accordance with ASTM Publication No. A123. Grade 65. It is important to specify ASTM A653 or ASTM A123 to insure the specific coating is furnished.

Grade 65 of ASTM A123 has an average zinc coating weight of 1.50 oz. per square foot (0.46 kg/m²) (2.55 mils or 0.064mm) average thickness per side).

Fabricated products which are hot-dip galvanized are thoroughly cleaned, fluxed, and immersed into a bath of molten zinc where they react to form a metallurgical bonded zinc coating. Normal oxidation of the galvanized surfaces will, in a short period of time, appear as a dull gray or white coating. Some degree of roughness and variations of thickness can be expected due to the hot dipping process. Because the galvanizing process takes place at the low end of the stress-relieving temperature range, some stress relief occurs and some distortion or warping may result.

C. Other equivalent commercially available coatings.

**2.2.2** Steel nuts and bolts shall be protected against corrosion by one of the following processes:

A. ASTM Publication No. B633
B. ASTM Publication No. B766
C. Other equivalent commercially available coatings.

**2.2.3** Where metallic cable tray is intended for installation in highly corrosive environments, including most alkaline and acidic conditions, further protection against corrosion shall be provided by one of the following processes:

A. PVC (Polyvinylchloride) — A PVC coating shall be applied in a fluidized bed or by electrostatic spray. The coating thickness shall be 15 mils (0.381mm) ± 5 mils (±0.127mm).

Items to be protected shall be thoroughly cleaned, primed, and then coated with a fine grain UV (ultraviolet) stabilized vinyl plastic powder.

All field cuts and damaged areas of coated tray shall be repaired with a compatible PVC compound to ensure a coating integrity.

A PVC coating is generally applied to bare steel cable tray but can also be applied in aluminum cable tray. PVC is not recommended as a coating on galvanized steel cable trays because of rough surfaces and gas emissions which cause voids and adhesion problems.

B. Other equivalent commercially available coatings.
2.3 DIMENSIONS

2.3.1 General
Plus or minus values stated reflect the range of nominal dimensions in cable tray designs and are not intended to represent manufacturing tolerances.

2.3.2 Ladder Trays
1. Lengths of Straight Sections – NEMA - 12’ (3660mm) ± ¾" (4.76mm) and 24’ (7320mm) ± ¾" (7.94mm), not including connectors if attached. CSA - 10’ (3000mm) ± ¾" (4.76mm) and 20’ (6000mm) ± ¾" (7.94mm), not including connectors if attached.

2. Widths - 6, 12, 18, 24, 30, and 36” (152mm, 305mm, 457mm, 610mm, 762mm and 914mm), ± ¼” (6.35mm), inside dimension. Overall widths shall not exceed inside widths by more than 4” (102mm).

3. Depths - Inside depths shall be 3”, 4”, 5”, and 6” (76.2mm, 102mm, 127mm, and 152mm), ± ¾” (9.53mm). Outside depths shall not exceed inside depths by more than 1½” (31.7mm).

4. Rung Spacing on Straight Sections - 6”, 9”, 12”, or 18” (152mm, 229mm, 305mm, or 457mm) on centers.

5. Radii - 12”, 24”, and 36” (305mm, 610mm, and 914mm).

6. Degree of Arc for Elbows - 30°, 45°, 60°, and 90°.

2.3.3 Trof Trays
1. Lengths of Straight Sections – NEMA - 12’ (3660mm) ± ¾” (4.76mm) and 24’ (7320mm) ± ¾” (7.94mm), not including connectors if attached. CSA - 10’ (3000mm) ± ¾” (4.76mm) and 20’ (6000mm) ± ¾” (7.94mm), not including connectors if attached.

2. Widths - 6”, 12”, 18”, 24”, 30”, and 36” (152mm, 305mm, 457mm, 610mm, 762mm and 914mm), ± ¼” (6.35mm) inside dimension. Overall widths shall not exceed inside widths by more than 4” (102mm).

3. Depths - Inside depths shall be 3”, 4”, 5”, and 6” (76.2mm, 102mm, 127mm, and 152mm), ± ¾” (9.53mm). Outside depths shall not exceed inside depths by more than 1½” (31.7mm).

4. Rung Spacing on Straight Sections - 6”, 9”, 12”, or 18” (152mm, 229mm, 305mm, or 457mm) on centers.

5. Radii - 12”, 24”, and 36” (305mm, 610mm, and 914mm).

6. Degree of Arc for Elbows - 30°, 45°, 60°, and 90°.

6. Transverse Elements - The maximum open spacing between transverse elements shall be 4” (102mm) measured in a direction parallel to the tray side rails.

2.3.4 Solid-Bottom Trays
1. Lengths of Straight Sections – NEMA - 12’ (3660mm) ± ¾” (4.76mm) and 24’ (7320mm) ± ¾” (7.94mm), not including connectors if attached. CSA - 10’ (3000mm) ± ¾” (4.76mm) and 20’ (6000mm) ± ¾” (7.94mm), not including connectors if attached.

2. Widths - 6, 12, 18, 24, 30, and 36” (152mm, 305mm, 457mm, 610mm, 762mm and 914mm), ± ¼” (6.35mm), inside dimension. Overall widths shall not exceed inside widths by more than 4” (102mm).

3. Depths - Inside depths shall be 3”, 4”, 5”, and 6” (76.2mm, 102mm, 127mm, and 152mm), ± ¾” (9.53mm). Outside depths shall not exceed inside depths by more than 1½” (31.7mm).

4. Radii - 12”, 24”, and 36” (305mm, 610mm, and 914mm).

5. Degree of Arc for Elbows - 30°, 45°, 60°, and 90°.

6. Bottom - Bottom is solid.

2.3.5 Channel Trays
1. Lengths of Straight Sections - 12’ (3660mm) ± ¾” (4.76mm) and 24’ (7320mm) ± ¾” (7.94mm), not including connectors if attached.

2. Widths - 3”, 4”, and 6” (76.2mm, 102mm, and 152mm), ± ¼” (6.35mm), inside dimension.

3. Depths - 1¼” to 1½” (31.7mm to 44.4mm) outside dimensions.

4. Radii - 12”, 24”, and 36” (305mm, 610mm, and 914mm).

5. Degree of Arc for Elbows - 30°, 45°, 60°, and 90°.

2.4 PROTECTION OF CABLE INSULATION
The inside of cable tray systems shall not have sharp edges, burrs, or projections which can damage cable insulation.

2.5 FITTINGS
The design and construction of fittings shall be based on the assumption that they will be supported in accordance with the recommendations given in 6.6 for support locations.

2.6 MARKING OF TRAYS WHEN USED AS EQUIPMENT GROUNDING CONDUCTORS
When steel or aluminum cable tray systems are used as equipment grounding conductors, cable tray sections and fittings shall be marked to show the minimum cross-sectional area in accordance with the Article 392 of the National Electrical Code®.
SECTION 3 - PERFORMANCE STANDARDS & LOAD/SPAN CLASS DESIGNATIONS

3.1 WORKING (ALLOWABLE) LOAD CAPACITY
The working (allowable) load capacity represents the ability of a cable tray to support the static weight of cables. It is equivalent to the destruction load capacity, as determined by testing in accordance with 4.1 divided by a safety factor of 1.5.

3.2 LOAD/SPAN CLASS DESIGNATIONS
There shall be three working load categories of cable tray:*  
50 lbs/linear ft. (74.4 kg/m) (Symbol A)  
75 lbs/linear ft. (111.6 kg/m) (Symbol B)  
100 lbs./linear ft. (148.8 kg/m) (Symbol C) and,  
four support span categories of:  
8’ (2.44m), 12’ (3.66m), 16’ (4.87m), 20’ (6.09m)

Utilizing these above, load/span class designations are presented in the table below:

<table>
<thead>
<tr>
<th>Working Lbs./Ft</th>
<th>Load (kg/m)</th>
<th>Support Feet</th>
<th>Span (m)</th>
<th>NEMA Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>(74.4)</td>
<td>8</td>
<td>(2.44)</td>
<td>8A</td>
</tr>
<tr>
<td>75</td>
<td>(116.6)</td>
<td>8</td>
<td>(2.44)</td>
<td>8B</td>
</tr>
<tr>
<td>100</td>
<td>(148.8)</td>
<td>8</td>
<td>(2.44)</td>
<td>8C</td>
</tr>
<tr>
<td></td>
<td>(74.4)</td>
<td>12</td>
<td>(3.66)</td>
<td>12A</td>
</tr>
<tr>
<td></td>
<td>(116.6)</td>
<td>12</td>
<td>(3.66)</td>
<td>12B</td>
</tr>
<tr>
<td></td>
<td>(148.8)</td>
<td>12</td>
<td>(3.66)</td>
<td>12C</td>
</tr>
<tr>
<td></td>
<td>(74.4)</td>
<td>16</td>
<td>(4.87)</td>
<td>16A</td>
</tr>
<tr>
<td></td>
<td>(116.6)</td>
<td>16</td>
<td>(4.87)</td>
<td>16B</td>
</tr>
<tr>
<td></td>
<td>(148.8)</td>
<td>16</td>
<td>(4.87)</td>
<td>16C</td>
</tr>
<tr>
<td></td>
<td>(74.4)</td>
<td>20</td>
<td>(6.09)</td>
<td>20A</td>
</tr>
<tr>
<td></td>
<td>(116.6)</td>
<td>20</td>
<td>(6.09)</td>
<td>20B</td>
</tr>
<tr>
<td></td>
<td>(148.8)</td>
<td>20</td>
<td>(6.09)</td>
<td>20C</td>
</tr>
</tbody>
</table>

NOTE 1 - The above working loads are for cable only; when considering applications requiring concentrated static load, see 6.2.

NOTE 2 - These designations do not apply to channel tray, and the manufacturer should be consulted.

NOTE 3 - For deflection see 6.1.

SECTION 4 - TEST STANDARDS

4.1 DESTRUCTION LOAD TEST

4.1.1 Test Specimen
For each design of cable tray, two separate tests shall be made. An un-spliced straight section of the widest width shall be used in each test.

For ladder type cable trays rung spacing shall be 12” on center.
For loading weight in a ladder-type tray, it shall be permissible to cover the bottom of the tray between supports with a flat sheet of No. 9 gauge (3.8 mm) flattened expanded material not more than 3’ (900 mm) long and with a wire hole size of 3⁄4” (19 mm), or a flat sheet of No. 16 gauge (1.5 mm) sheet steel not more than 3’ (900 mm) long. The expanded metal or sheet steel shall not be fastened to the tray and shall be no closer than 1⁄2” (13 mm) to the side rails. The 3’ (900 mm) lengths shall not overlap by more than 2” (50 mm). The weight of the expanded metal or sheet steel shall be added to the total weight of the loading material.

4.1.7 Destruction Load Capacity
The total weight of the loading material on the cable tray at the time it is destroyed less the last incremental weight added shall be considered to be the destruction load capacity of the cable tray. The Rated Load Capacity shall be the Destruction Load Capacity divided by a safety factor of 1.5.

4.1.8 Interpolation & Extrapolation of Test Data
When allowable load and deflection data are determined by load tests, values for span lengths not tested shall be determined by interpolation from a curve based on values for a minimum of the two (2) span lengths. Extrapolation for shorter span lengths is permissible using the formula below, however extrapolation shall not be used for span lengths longer than the longest span length tested.

\[
W_2 = \frac{(W_1 \times L_1^2)}{L_2^2}
\]

Where:
- \(W_1\) = Tested Load, lbs/ft (kg/m)
- \(W_2\) = Load on Shorter Span, lbs/ft (kg/m)
- \(L_1\) = Tested Span Length, ft (m)
- \(L_2\) = Shorter Span Length, ft (m)

4.2 RESIDUAL DEFLECTION TEST
Determine the Minimum Test Load (MTL) from the formula:

\[
MTL = 1.5 \times L \times W
\]

Where:
- \(1.5\) = Safety Factor
- \(L\) = Span Length, ft (m)
- \(W\) = Rated Load at Span Length, lbs/ft (kg/m)

A minimum of two (2) tray specimens shall be tested. The following procedure shall be used for each tray.

1. Load tray to 10% of MTL. Measure the vertical deflection of the tray at two (2) points along the line midway between the supports and at right angles to the longitudinal axis of the tray. The two points shall be at the midpoint of the span and under each side rail. The two readings shall be considered to be the initial deflection of the tray.
2. Continue loading until the Rated Load (W) has been applied. Measure the deflection at the same points as for the initial deflection measurement above.
3. Continue loading until the Minimum Test Load (MTL) has been applied. Remove the all load from the tray and wait 15 minutes before measuring the deflection at the previous two points. This final measurement is known as the residual deflection of the tray specimen.

Average the residual deflections of the two (2) test specimens. This shall be considered the final result. However, if the residual deflection for either specimen is > 80% of the initial deflection, and in addition, deviates from the average by more than 10%, then two more specimens shall be tested. The average of the three highest values at the point of measurement of the four specimens shall be considered the final result.

4.3 ELECTRICAL CONTINUITY OF CONNECTIONS

4.3.1 Test Specimen
Each specimen shall consist of two 24” (600 mm) lengths of side rail connected by the manufacturer's standard splice.

4.3.2 Resistance Test Procedure
Each specimen should be joined together, using the mechanical connector, and following the instructions provided by the manufacturer. A current of 30 amperes DC shall be passed through the specimen and the resistance measured between two points 1⁄16” (1.6 mm) from each side of the splice. The net resistance of the joint shall be not more than 0.00033 ohm as computed from the measured voltage drop and the current passing through the specimen. The ambient temperature of the specimen shall be between 60° and 90°F (15° to 35°C). The current shall be applied to the specimen at least 12” (300 mm) from the splice joint.

SECTION 5 - SPECIFICATIONS & DRAWINGS

5.1 DATA TO APPEAR IN SPECIFICATIONS
The following statement and minimum data, when applicable, should appear in all cable tray specifications:
- Cable tray shall be manufactured and installed in accordance with NEMA Standard VE 1-2002
- Load / Support Span Class Designation (see Table 1)
- Type (see Section 1.2 Definitions)
- Material (see Section 2.1)
- Finish (see Section 2.2)
- Tray Length (see Section 2.3)
- Width (see Section 2.3)
- Inside Depth (see Section 2.3)
- Rung Spacing (see Section 2.3)
- Fitting Radius (see Section 2.3).
5.2 DATA TO APPEAR ON DRAWINGS

The following minimum data should appear on all cable tray drawings:
- Type (ladder, trof, etc.)
- Width(s)
- Load depth
- Straight section, fitting, or accessory
- Fitting radii
- Elevation (bottom of tray)
- Vertical and horizontal changes in direction
- Clearances-vertical and horizontal
- Number of trays (if there is a stack of trays)
- Support span
- Show graphic scale

SECTION 6 - APPLICATION INFORMATION

6.1 DEFLECTION

Under normal applications deflection limitations should not be included in design criteria for cable trays. However, if unusual or special conditions exist, the manufacturer should be consulted. Limitations of deflection for aesthetic purpose only can result in an over-designed tray system.

6.2 CONCENTRATED STATIC LOAD
(If Required by User)

A concentrated static load is not included in the Load/Span Designations NEMA VE-1, Table 1. Some user applications may require that a given concentrated static load be imposed over and above the working load.

Such a concentrated static load represents a static weight applied between the side rails at midspan. When so specified, the concentrated static load may be converted to an equivalent, uniform load \( W_s \) in pounds per linear foot (kilograms per meter) using the formula: (see NEMA VE-2, Section 4.8.2)

\[
W_s = 2 \times \frac{\text{Concentrated Static Load}}{\text{span length, ft. (m)}}
\]

The value for \( W_s \) will be added to the static weight of cables in the tray. This combined load may be used to select the appropriate load/span designation NEMA VE-1, Table 1. If the combined load exceeds the working load shown in the load/span designation table, the manufacturer should be consulted.

6.3 WARNING! WALKWAYS

Inasmuch as cable tray is designed as a support for power or control cables, or both, and is not intended or designed to be a walkway for personnel, the user is urged to display appropriate warnings cautioning against the use of this support as a walkway. The following language is suggested:

Warning! Not to be used as a walkway, ladder or support for personnel. To be used only as a mechanical support for cables and tubing.

6.4 FITTINGS

Changes in direction should be mechanically continuous and accomplished by use of fittings having dimensions in accordance with 2.5.

6.5 SUPPORTS

Supports for cable trays should provide strength and working load capacity sufficient to meet the load requirement of the cable tray systems.

Horizontal and vertical tray supports should provide an adequate bearing surface for the tray and should have provisions for hold down clamps or fasteners.

In addition, vertical tray supports should provide secured means for fastening cable trays to supports.

6.6 SUPPORT LOCATIONS

For complete information on cable tray support, please refer to NEMA Standard VE-2-2006.

6.6.1 Horizontal Cable Tray Straight Sections

Horizontal cable tray straight sections should be supported at intervals not to exceed the support span for the appropriate NEMA Class Designation shown in NEMA VE-1, Table 1. Un-spliced straight sections should be used on all simple spans and on end spans of continuous span runs. A support should be located within 2' (610mm) of each side of an expansion connector. Straight section lengths should be equal to or greater than the span length to ensure not more than one splice between supports.

6.6.2 Horizontal Cable Tray Fittings

1. Horizontal Elbow Supports for horizontal tray fittings should be placed within 2' (600 mm) of each fitting extremity, and as follows: (See page 15, Figure 6-1 for a graphic presentation of fitting supports.)
   (a) 90° supports at the 45° point of arc.
   (b) 60° supports at the 30° point of arc.
   (c) 45° supports at the 221⁄2° point of arc (except for the 12” (300 mm) radii).
   (d) 30° supports at the 15° point of arc (except for the 12” (300 mm) radii).

2. Horizontal Tee Supports shall be placed within 2' (600 mm) of each of the three openings connected to other cable tray items for 12” (300 mm) radius fittings. On all other radii, at least one support should be placed under each side rail of the horizontal tee, preferably as shown in Figure 6-2, page 15.
3. Horizontal Cross Supports shall be placed within 2' (600 mm) of each of the four openings connected to other cable tray items for 12” (300 mm) radius fittings. On all other radii, at least one support should be placed under each side rail of the horizontal cross, preferably as shown in Figure 6-3, page 15.

4. Horizontal Wye Supports shall be placed within 2' of each of the three openings connected to other cable tray items, and at 22½° point of the arc adjacent to the branch as shown in Figure 6-4, page 15.

5. Reducer Supports shall be placed within 2' (600 mm) of each fitting extremity as shown in Figure 6-5 and 6-6, page 15.

6. Vertical Cable Tray Elbows should be supported at the top of runs at each end of the fitting. Vertical cable tray elbows at the bottom of runs should be supported at the top of the elbow and within 2' (600 mm) of the lower extremity of the elbow as shown in Figure 6-7, page 15.

7. Vertical Cable Tray Tees should be supported within 2' (600 mm) of each fitting extremity as shown in Figure 6-8, page 15.

6.6.3 Vertical Straight Sections
Vertical straight sections should be supported indoors at appropriate intervals permitted by the building structure; outdoor support intervals should be determined by wind loading. The maximum distance between vertical supports should not exceed 24' (7,320 mm) on centers.

6.6.4 Sloping Trays
Sloping trays should be supported at intervals not exceeding those for horizontal trays of the same design for the same installation.

6.6.5 Fittings as End of Run
A fitting which is used as an end of the run dropout should have a support attached to it, firmly reinforcing the fitting.

6.7 PROTECTION OF CABLE INSULATION
The inside of cable tray systems should present no sharp edges, burrs, or projections which could damage cable insulation.

6.8 THERMAL CONTRACTION AND EXPANSION
It is important that thermal contraction and expansion be considered when installing cable tray systems. If it is determined that expansion connectors are required, reference should be made to table on page 11 for maximum spacing between supports and to the table on page 11 to determine the proper splice plate setting.

The cable tray should be securely fixed at the support nearest to its midpoint between the expansion connectors and secured by expansion guides at all other support locations. The cable tray should be permitted longitudinal movement in both directions from that fixed point towards the expansion connectors.

Accurate gap setting at the time of installation is necessary for the proper operation of the expansion connectors. The following procedure should assist the installer in determining the correct gap:

Step 1 - Plot the highest expected cable tray metal temperature on the maximum temperature vertical axis. Example’s Value = 100°F. (See page 11).

Step 2 - Plot the lowest expected cable tray metal temperature on the minimum temperature vertical axis. Example’s Value = -28° F.

Step 3 - Draw a line between these maximum and minimum temperature points on the two vertical axis.

Step 4 - To determine the required expansion joint gap setting: Plot the cable tray metal temperature at the time of the cable tray installation on the Maximum temperature vertical axis. (Example’s Value = 50° F).

Project over from the 50°F point on the maximum temperature vertical axis to an intersection with the line between the maximum and minimum cable tray metal temperatures. From this intersection point, project down to the gap setting horizontal axis to find the correct gap setting value (Example’s value: ¾” gap setting). This is the length of the gap to be set between the cable tray sections at the expansion joint splice plate location.

NOTE: THE MAXIMUM GAP SPACE BETWEEN TRAY SECTIONS IS 1” (25 MM).

6.9 CABLE INSTALLATION
When installing cable in cable tray, it is important that care and planning be exercised so that the cable or the cable tray is not damaged or destroyed. The cable manufacturer should be contacted for maximum pulling tensions and minimum bending radii, and advice on prevention of “egging” or deformation of cable jacketing or shielding.
NEMA CLASS
The NEMA Classifications for Cable Tray were established to simplify and standardize the specification of Cable Tray. This classification is based on the working load (the total weight of the cables) and the support span (the distance between supports). The NEMA VE1 specifications are contained in Section 2.

Allied Tube & Conduit® Corporation is a member of NEMA and offers designs in all NEMA cable tray classifications.

Cable Load/Working Load
The Cable Load or the working load is the total weight of the cables to be placed in the tray. The NEMA classes are based on cable loads of 50#, 75#, and 100# per Lineal Foot. This is the total weight of cables in the tray. For purposes of selecting a suitable tray, this weight should be rounded off to the next higher NEMA working (allowable) load.

Support Spans
Support span is the distance between the supports. The NEMA standard support spans are based on 8’, 12’, 16’ and 20’.

NEMA Classes
The following table summarizes the NEMA classes based on cable/working load and support span described previously.

<table>
<thead>
<tr>
<th>NEMA Load/Span Designations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Designation</td>
</tr>
<tr>
<td>8A</td>
</tr>
<tr>
<td>8B</td>
</tr>
<tr>
<td>8C</td>
</tr>
<tr>
<td>12A</td>
</tr>
<tr>
<td>12B</td>
</tr>
<tr>
<td>12C</td>
</tr>
<tr>
<td>16A</td>
</tr>
<tr>
<td>16B</td>
</tr>
<tr>
<td>16C</td>
</tr>
<tr>
<td>20A</td>
</tr>
<tr>
<td>20B</td>
</tr>
<tr>
<td>20C</td>
</tr>
</tbody>
</table>

To determine what NEMA load class is required for your project, refer to the National Electrical Code® (NEC®). Determine type of cable and the appropriate cable tray type based on NEC® Article 392 guidelines. Establish the number and type of cables required in each cable tray run; then calculate the total number of square inches of cable in the run. Using NEC®, Article 392.9, Tables 392.9(A), 392.9(C), 392.9(E), 392.9(F), and 392.10(A), determine the allowable cable fill for the type of cable tray and cable being used. The number of square inches of installed cable divided by the allowable cable fill percentage will determine the size of the cable tray needed.

Calculated the total weight of cables (in pounds per linear foot) to be installed in the cable tray. Determine the frequency of cable tray supports (span). Example: Project requires 50 multiple conductor cables in a tray. The cable is .5” in diameter and weighs .3 pounds per foot. The tray selected is a ventilated bottom trof tray and will be supported every 12 feet. Tray Size Calculation: Area = 3.14 x .252 = 0.19625 sq. in. per cable. 50 cables multiplied by .019625 sq. in. = 0.98125 total sq inches of cable. 9.8125 sq. in. divided by .5 (% fill allowed) = 19.625 sq. in. minimum needed within the tray. Divide 19.625 sq. in. by 4” (load depth of a tray) = 4.9” wide tray minimum. The closest standard tray is a 4” load Depth x 6” Wide. Weight Calculation: 50 cables multiplied by .3 pounds per foot = 15 pounds per foot of cable. Select a NEMA 12A rated tray which will hold 50 pounds of weight when supported every 12 feet.

OTHER LOADING CONSIDERATIONS
It is important to note that when specifying loading requirements, there are other loading factors that may need to be considered over and above the actual cable loads.

Destruction Load Capacity
The total weight in the tray which causes the tray to collapse is called the “destruction load capacity”. When trays do collapse, they generally do so by premature lateral buckling (compression) of the top flange.

Concentrated Loads
A concentrated load is a static weight applied between the side rails at mid span. When specified, these concentrated static loads may be converted to an equivalent uniform load (Wc), in pounds per lineal foot, using the following formula:

\[ W_c = 2 \times \text{Concentrated Load} \times \text{Support Span} \]

This load \(W_c\) is then added to the static weight of the cable before selecting the appropriate NEMA load span designation.

Please note per the NEMA VE-1 guidelines all Cope™ Cable Trays are labeled as follows:

<table>
<thead>
<tr>
<th>ORDER NO.</th>
<th>PART NUMBER</th>
<th>LINE 4</th>
<th>P.O. NO.</th>
<th>NEMA VE-1/FG-1 LOAD CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C26074</td>
<td>1B48-06SL-12-09</td>
<td>574311WW</td>
<td>1B48-06SL-12-09</td>
<td>12B</td>
</tr>
</tbody>
</table>

WARNING!
DO NOT USE AS A WALKWAY, LADDER OR SUPPORT FOR PERSONNEL. TO BE USED ONLY AS A MECHANICAL SUPPORT FOR CABLES AND TUBING.

*TORQUE 3/8" DIAMETER HARDWARE TO 20 FT.-LBS.*

Cable Tray Systems
ENVIRONMENTAL LOAD CONSIDERATIONS

Environmental loads should be considered in any outdoor installation, particularly when cable tray is to be covered. These loads include wind loads, snow loads, and ice loads. Specific information data concerning these loads can be obtained by contacting the Cope Factory. Other sources for this type of information can be obtained through the local weather bureau.

It is important to note that these types of loads need to be considered in terms of pounds per square feet, unlike the cable loads, which are calculated in terms of pounds per linear foot.

The following are general guidelines to follow:

- **Wind Loads**
  75 m.p.h. wind = 25 lbs./sq. ft. pressure

- **Ice Loads**
  1/2" thick ice on tray surfaces weighs 2.4 lbs/sq. ft.

- **Snow Loads**
  Snow loads vary greatly depending on the latitude and altitude at the job site. Contact local weather bureau for information.

SAFETY FACTOR

All loads stated in the Cope Selection Charts have a 1.5 safety factor, in accordance with the NEMA VE-1 Guidelines. A safety factor is the reserve strength, above the actual cable loading, for which a tray system was designed.

Conversion of Safety factor from 1.5 to 2.0

The loads stated in the Selection Charts have a safety factor of 1.5 per the NEMA VE-1 guidelines. To convert the load carrying capabilities, as listed in these charts, to a 2.0 safety factor, multiply the stated loads by 0.75.

Testing Methods

Loading data stated in the catalog has been derived from actual testing of the tray systems, or by means of structural calculations. These figures were based on Simple Beam calculation, per the NEMA VE-1 guidelines.

When tray is supported as a simple beam, the load causes bending moments all along the beam resulting in deflection, called sag, inducing stress in the beam. The material above the longitudinal center line (neutral axis) is compressed. Material below is stretched and is in tension. The maximum stress in a simple beam is at the center of the span. Failure of cable tray will occur in compression before tension. This is why tray rails often have stiffened top flanges.

A simple beam is present when a single straight section of tray is supported on each end. When a series of straight sections are connected and supported by more than one support it is referred to as a continuous beam. The NEMA VE-1 Standards consider only simple beams for testing purposes, due to the following reasons:

1. It requires maximum properties for a given load and support spacing.
2. It is easiest to approximate by calculation.
3. It represents the most severe or worst case loading.
4. Destruction load capacities can be easily verified.

DEFLECTION VS. ECONOMY

Cable tray that meets all performance and dimensional criteria with the safety factor specified without regard for deflection is the most economical tray for the installation. When deflection limitations are imposed, a less economical tray system may result. We recommend that deflection limitations should be imposed in only the most stringent situations. If deflection is a concern, we recommend these maximum limits for the optimum design.

<table>
<thead>
<tr>
<th></th>
<th>Simple Beam Span</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12'</td>
</tr>
<tr>
<td></td>
<td>20'</td>
</tr>
<tr>
<td>STEEL</td>
<td>1/100</td>
</tr>
<tr>
<td>ALUMINUM</td>
<td>1/75</td>
</tr>
<tr>
<td></td>
<td>1/50</td>
</tr>
</tbody>
</table>
OVERVIEW

CAVITY SIZE – LOAD DEPTH/WIDTH OF TRAY
The size of the cable tray cavity is determined specifically by the electrical requirements and by the specific cables being used to meet those requirements.

Article 392 of the National Electrical Code® lists the specific requirements concerning allowable Cable Fill. It is imperative that the size of the cavity meets the conditions set forth by the NEC®, specifically:

- Types of cables allowed in which type of cable trays
- Requirements for arranging the cables in the trays.

The NEC® breaks down the allowable cable fill into three main categories:

- **Multi-Conductor**: The number of multi-conductor cables rated at 2000 volts or less in cable tray.
- **Single conductor**: The number of single conductor cables rated at 2000 volts or less in cable tray.
- **MV and MC Cables**: The number of MV & MC cables rated at 2001 volts or over in the cable tray.

Cable fill guidelines set forth by the NEC® are generally based on limiting heat build up in the trays. Where data or communications type cables are being installed, heat is not a critical issue and the allowable fill is determined by the total cross sectional area of the tray cavity:

\[ \text{Total Cross Sectional Area} = (\text{Width}) \times (\text{Load Depth}) \]

LENGTH OF STRAIGHT SECTIONS
Cope Cable Tray is available in 12’ and 24’ lengths in accordance with the NEMA Standards. It is also available in 10’ and 20’ lengths in accordance with CSA Standards. Customized lengths are also available upon request.

The following factors need to be considered when specifying the lengths of the tray:

- **Support Span** – The support span should not be greater than the tray length. This ensures that two splice plate connections will not fall within one support span.
- **Space Constraints** – When installing trays in a limited space, as often encountered in commercial applications, 10’ and 12’ lengths of tray are easier to handle and therefore are better suited for those applications.
- **Labor Costs** – Where trays are being installed in an industrial facility, where space is not as significant an issue, handling 20’ and 24’ lengths may be more economical. In this instance, half as many tray connections need to be made. Additionally, if the proper tray system is specified, support spans may be lengthened.

RADIUS OF FITTINGS
Cable tray fittings are used to change directions both horizontally and vertically. The standard radii for cable tray fittings are 12”, 24”, and 36”.

The radius of the fittings should be based upon minimum bending radius of the cables. This information can be obtained from the cable manufacturer.

Based on the total number of cables to be placed in the tray, it may be more practical to use the next higher radius.

CABLE TRAY SUPPORT LOCATIONS

**Straight Sections**
A general rule of thumb is that the splice plates should not fall beyond the 1/4 point of the span, or the distance between supports. For example: On a 20’ support span the splice plates should not be further than 5’ away from the support location.

Under no circumstances should two cable tray splices fall between any pair of supports.

For special applications, mid-span splice plates can be furnished. Please contact the factory.

**Fittings**
Supports for cable tray elbows are critical. It is important to note that the cable tray will come under its greatest stress when cables are being pulled into the tray. Therefore, proper placement of supports is necessary to insure that the integrity of the tray system is maintained during the cable pulling operation.

The diagrams on page 15 shows the recommended support locations for fittings.

**Thermal Expansion and Contraction**
It is important to use expansion connectors when installing long runs of cable tray. The number of expansion connectors required will depend on:

1. the maximum temperature differential
2. the tray material being installed

Cope Expansion Connectors allow 1” of travel. This table illustrates how often expansion splice plates must be used.

<table>
<thead>
<tr>
<th>Temperature Difference</th>
<th>Dist. Between Expansion Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steel</td>
</tr>
<tr>
<td>25°F (14°C)</td>
<td>512’</td>
</tr>
<tr>
<td>50°F (28°C)</td>
<td>256’</td>
</tr>
<tr>
<td>75°F (42°C)</td>
<td>171’</td>
</tr>
<tr>
<td>100°F (56°C)</td>
<td>128’</td>
</tr>
<tr>
<td>125°F (70°C)</td>
<td>102’</td>
</tr>
<tr>
<td>150°F (83°C)</td>
<td>85’</td>
</tr>
<tr>
<td>175°F (97°C)</td>
<td>73’</td>
</tr>
</tbody>
</table>
The following table is used to determine the proper gap setting between trays. The metal temperature determines the proper gap setting at the time of installation. Establish maximum and minimum temperatures in summer and winter for the area. Draw a line connecting them. Using the metal temperature at time of installation (°C or °F) draw horizontal to temperature slope and plot straight down to find gap distance at expansion joint.

The following diagram illustrates the proper installation of an expansion system.

It is important to note that grounding straps are required when expansion connections are made. This will insure proper grounding continuity.

**ELECTRICAL GROUNDING**

The National Electrical Code®, Article 392-7 allows for Cable Tray to be used as an equipment grounding conductor in commercial and industrial establishments. The following table lists specific ampere ratings and the minimum cross sectional area requirements for each rating.

Allied Tube & Conduit Corporation produces trays that meet the National Electrical Code® (ANSI/NFPA 70), and are classified by Underwriters Laboratories, Inc. (UL) as equipment ground conductors. These can be used for any project worldwide except where another standard may take precedence, such as the Canadian Standards Association.

For projects requiring adherence to the Canadian Standards Association (CSA), Cope products as shown in the CSA Selection Charts, pages 34-35 of Cope Product Catalog, and 142-143 are certified as complying with CSA C22.2 No. O and No. 126 and will bear the CSA Mark as shown below.

When required, the trays can be installed per the Canadian Electrical Code Parts I and II (CEC). Cope trays and splice plates meet the bonding requirements of the CSA Standards and the CEC.

<table>
<thead>
<tr>
<th>Max. Fuse Amp Rating</th>
<th>Circuit Breaker Amp Trip Setting for Ground Fault Protection of any Cable Tray Circuit</th>
<th>Minimum Cross Sectional Area of Metal* Steel Cable Trays In²</th>
<th>Minimum Cross Sectional Area of Aluminum Cable Trays In²</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>0.2</td>
<td>129</td>
<td>0.2</td>
</tr>
<tr>
<td>100</td>
<td>0.4</td>
<td>258</td>
<td>0.2</td>
</tr>
<tr>
<td>200</td>
<td>0.7</td>
<td>452</td>
<td>0.2</td>
</tr>
<tr>
<td>400</td>
<td>1</td>
<td>645</td>
<td>0.4</td>
</tr>
<tr>
<td>600</td>
<td>1.50**</td>
<td>968</td>
<td>0.4</td>
</tr>
<tr>
<td>1,000</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
</tr>
<tr>
<td>1,200</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>1,600</td>
<td>-</td>
<td>-</td>
<td>1.5</td>
</tr>
<tr>
<td>2,000</td>
<td>-</td>
<td>-</td>
<td>2.00**</td>
</tr>
</tbody>
</table>

* Total cross sectional area of both side rails for ladder and troff type trays, or the minimum cross sectional area for metal in channel type cable trays or cable trays of one piece construction.

** Steel cable trays shall not be used as equipment grounding conductors for circuits with ground-fault protection above 600 amperes. Aluminum cable trays shall not be used as equipment grounding conductors for circuits with ground-fault protection above 2000 amperes.
TECHNICAL DATA

OVERVIEW

Cope CSA steel designs are offered in Type 1 (HDGAF) finish and aluminum with plain finish. Available are ladder, vented, and solid bottom cable Trofs for 3 meter spans and ladder type for 6 meter spans.

The cross-sectional area for each Cope Cable Tray system, straight sections and fittings, can be found on the appropriate Cope Selection charts contained within this publication. In addition all Cope Cable Tray, straight sections and fittings, are supplied with pressure sensitive labels indicating the cross sectional area of both side rails, as required by the (NEC®) National Electrical Code®, Article 392.

Bonding Jumpers / Straps

Cable Tray connections made with Cope's standard rigid splice plates do not exceed .00033 ohms net resistance, and are classified in Underwriters Laboratories Classification Program. These rigid type connections do not require electrical bonding straps. Cope's UL assigned number is “E60627”. UL cards will be furnished upon request. Cope is listed in the UL Electrical Construction Directory under code CYNW.

Electrical bonding straps are required where cable trays are joined by connectors which allow for movement, such as vertical adjustable connectors, horizontal adjustable connectors, and expansion connectors.

Proper grounding is also necessary where cable trays run parallel to each other, are stacked upon one another, and in other instances, where tray runs are discontinuous.

Further questions concerning grounding issues should be directed to Allied Tube & Conduit Corporation.

SUMMARY

You are now ready to select the best Cope Cable Tray system to meet your needs. By now, we hope you've decided to select the system using the NEMA CLASSIFICATION (8A, 12B, 20C, etc.) which makes your work so much easier. Selection is also possible using physical dimensions, performance, or any combination of these data listed in our exclusive NEMA oriented Cope selection charts. As always, should you need additional information, we suggest you contact your nearest Cope Representative or call Allied Tube & Conduit Corporation directly.

<table>
<thead>
<tr>
<th>NEC® Articles</th>
<th>Description</th>
<th>2002 and Later Editions</th>
<th>1999 &amp; Prior Editions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cable Trays</td>
<td>392</td>
<td>318</td>
</tr>
</tbody>
</table>
Figure 6-1
HORIZONTAL ELBOWS

Figure 6-2
HORIZONTAL TEE

Figure 6-3
HORIZONTAL CROSS

Figure 6-4
HORIZONTAL WYE

Figure 6-5
STRAIGHT REDUCER

Figure 6-6
OFFSET REDUCER

Figure 6-7
VERTICAL ELBOWS

Figure 6-8
VERTICAL TEE