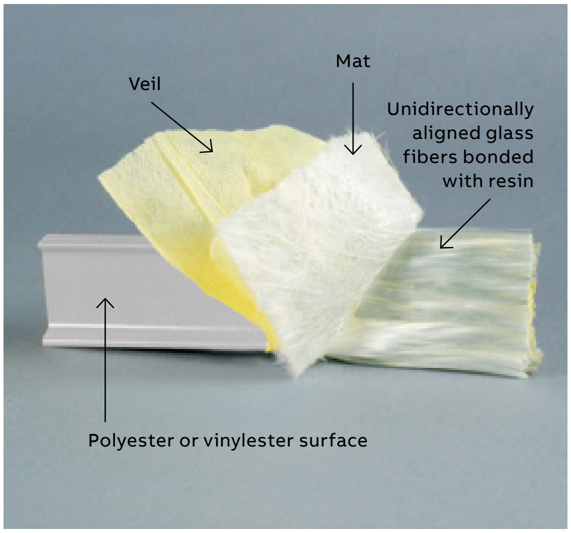
Nonmetallic - Cable tray
Overview

Why specify our cable tray?
Nonmetallic cable tray systems have been tested and proven in the harsh environment of the offshore oil and gas industry. This tray is ideally suited to withstand the corrosive conditions inherent in the petroleum, mining, and fertilizer industries. In these applications, nonmetallic tray is exposed daily to wind, weather, and saltwater.

Nonmetallic cable tray gives you the load capacity of steel plus the inherent characteristics afforded by our pultrusion technology: non-conductive, non-magnetic and corrosion-resistant. Although light in weight, their strength-to-weight ratio surpasses that of equivalent steel products.



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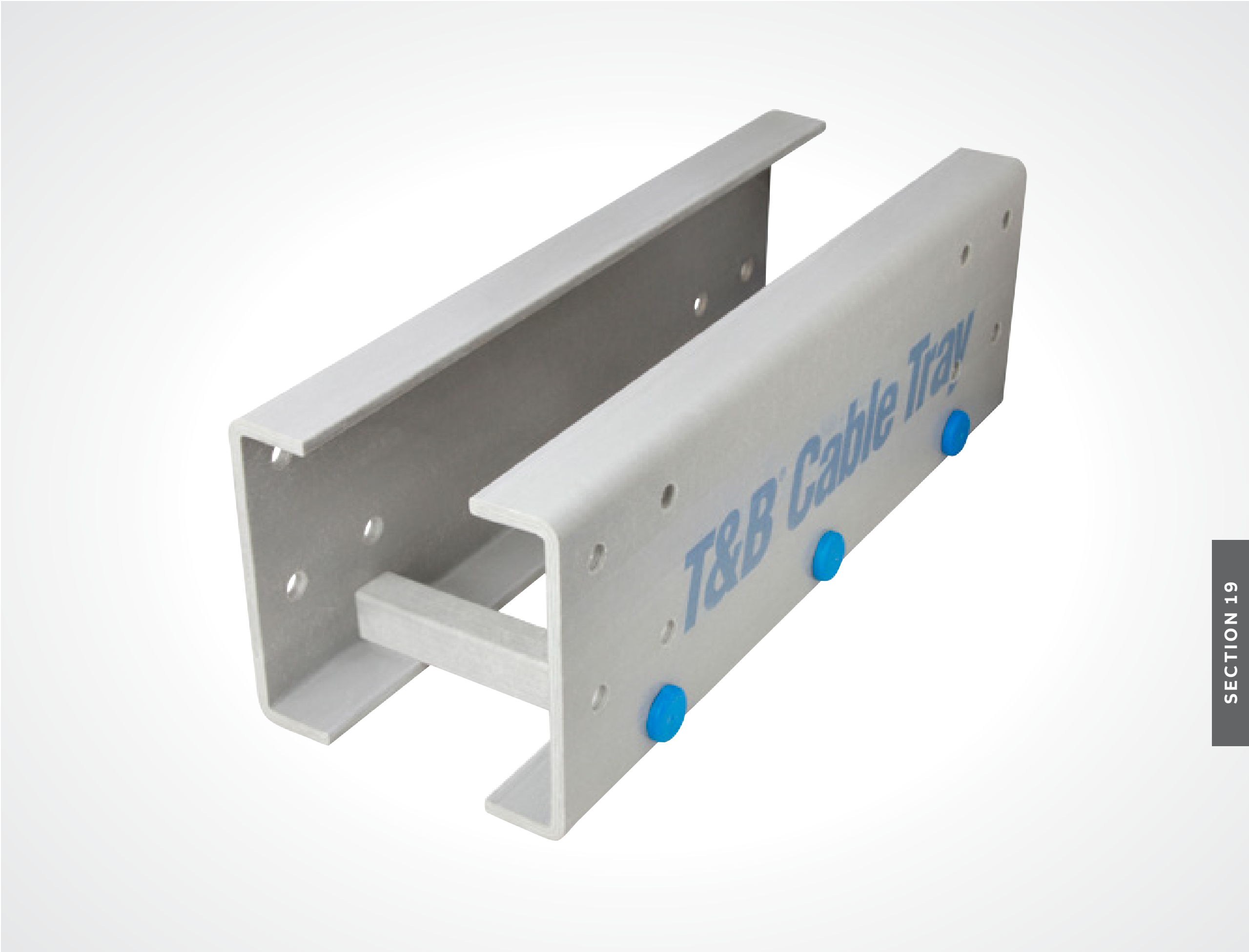
01 A surface veil is applied during the pultrusion process to ensure a resin rich surface for superior corrosion resistance as well as an ultraviolet exposure barrier.



Nonmetallic - Cable tray
Overview *(continued)*

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Table 1 – Typical properties of pultruded components gland

			Isophthalic Polyester	
Properties	**Test method**	**Unit/value**	**Longitudinal**	**Transverse**
Tensile strength	ASTM D638	psi	30,000	7,000
Tensile modulus	ASTM D638	psi x 10^6	2.5	0.8
Flexural strength	ASTM D790	psi	30,000	10,000
Flexural modulus	ASTM D790	psi x 10^6	1.6	0.8
Izod impact	ASTM D256	ft.-lbs/in	25	4
Compressive strength	ASTM D695	psi	30,000	15,000
Compressive modulus	ASTM D695	psi x 10^6	2.5	1.0
Barcol hardness	ASTM D2583	–	50	45
Shear strength	ASTM D732	psi	5,500	5,500
Density	ASTM D1505	lbs/in3	0.065	–
Coefficient of thermal expansion	ASTM D696	in/in/°F	5.0 x 10-6	–
Water absorption	ASTM D570	Max %	0.5	–
Dielectic strength	ASTM D149	V/mil (vpm)	200	–
Flammability classification	UL94	VO (both resins)	–	–
Flame spread	ASTM E-84	20 Max (both resins)	–	–

T&B nonmetallic cable tray systems are manufactured from glass fiber-reinforced plastic shapes that meet the ASTM E-84 Class 1 flame rating and self-extinguishing requirements of ASTM D-635. A surface veil is applied during pultrusion to ensure a resin-rich surface and ultraviolet resistance.

Table 1 – Typical properties of pultruded components gland

Properties	**Ignition**	**Burning**	**Rating**	**Avg. Extent of Burning**
Flame resistance (FTMS 406-2023)	75 seconds	75 seconds	–	–
Intermittent flame test (HLT- 15)	–	–	100	–
Flammability test (ASTM D635)	–	5 seconds	–	15mm

Technical information

Corrosion guide

The information shown in this corrosion guide is based on full immersion laboratory tests and data generated from resin manufacturers. It should be noted that in some of the environments listed, splashes and spills may result in a more corrosive situation than indicated due to the evaporation of water. Regular wash down is recommended in these situations.

Chemical resistance

Chemical environment	75°F (24°C)	160F° (71°C)
Acetic Acid 5%	FR-P	FR-P
Acetic Acid 25%	FR-P	FR-VE-210° (*)
Aluminum Potassium Sulfate 5%	FR-P	FR-P
Ammonium Hydroxide 10%	FR-P	FR-VE-150°
Ammonium Nitrate	FR-P	FR-P
Benzenesulfonic Acid 5%	FR-P	FR-P
Calcium Chloride	FR-P	FR-P
Carbon Tetrachloride	FR-VE	FR-VE-100° (*)
Chlorine Dioxide 15%	FR-P	FR-VE-150° (*)
Chromic Acid 5%	FR-P	FR-VE-150° (*call)
Copper Sulfate	FR-P	FR-P
Diesel Fuel No. 1	FR-P	FR-P
Diesel Fuel No. 2	FR-P	FR-P
Ethylene Glycol	FR-P	FR-P
Fatty Acids 100%	FR-P	FR-P
Ferrous Sulfate	FR-P	FR-P
Fluosilicic Acid 0-20%	FR-VE	FR-VE (call)
Hydrochloric Acid 1%	FR-P	FR-P
Hydrochloric Acid 15%	FR-P	FR-VE-180° (*)
Hydrochloric Acid 37%	FR-P	FR-VE-150° (*)
Hydrogen Sulfide	FR-P-140°	FR-VE-210°
Kerosene	FR-P	FR-P
Magnesium Chloride	FR-P	FR-P

Chemical environment	75°F (24°C)	160F° (71°C)
Methyl Alcohol 10%	FR-P	FR-VE-150° (*)
Naphtha	FR-P	FR-P
Nitric Acid 5%	FR-P	FR-P
Nitric Acid 20%	FR-VE	FR-VE-120° (*)
Phosphoric Acid 10%	FR-P	FR-P
Phosphoric Acid 30%	FR-P	FR-P
Phosphoric Acid 85%	FR-P	FR-P
Sodium Bicarbonate 10%	FR-P	FR-P
Sodium Bisulfate	FR-P	FR-P
Sodium Carbonate	FR-P	FR-VE
Sodium Chloride	FR-P	FR-P
Sodium Hydroxide 1-50%	FR-VE	FR-VE-120° (*)
Sodium Hypochlorite 5%	FR-P	FR-VE-120° (*)
Sodium Nitrate	FR-P	FR-P
Sodium Silicate	FR-P	FR-VE-210° (*)
Sodium Sulfate	FR-P	FR-P
Sulfuric Acid 0-30%	FR-P	FR-P
Sulfuric Acid 30-50%	FR-VE	FR-VE
Sulfuric Acid 50-70%	FR-VE	FR-VE-180° (*)
Trisodium Phosphate 25%	FR-P	FR-VE-210° (*)
Trisodium Phosphate - All	FR-VE	FR-VE-210° (*)
Water, Distilled	FR-P	FR-P

Symbols:
FRP - Polyester fire-retardant
FRVE - Vinyl Ester fire-retardant

All data represents the best available information and is believed to be correct. The data should not be construed as a warranty of performance for that product as presented in these tables. User tests should be performed to determine suitabiity of service if there is any doubt or concern. Such variables as concentration, temperature, time of exposure and combined chemical effects of mixtures of chemicals make it impossible to specify the exact suitability of fiber-reinforced plastics in all environments. ABB will be happy to supply material samples for testing. These recommendations should only be used as a guide, and ABB does not take responsibility for design or suitability of materials for service intended. In no event will ABB be liable for any consequential or special damages for any defective material or workmanship including, without limitation, labor charges or other expenses or damage to property resulting from loss of materials or profits or increased expenses of operations.

Technical information
CSA and NEMA loading classes

The standard classes of cable trays, as related to their maximum design loads and to the associated design support spacing based on a simple beam span requirement, shall be designated in accordance with Table 1.

Selection process

Please note the load ratings in Table 1 are those most commonly used. Other load ratings are acceptable. (according to NEMA VE-1/CSA C22.2 No 126.1-02).

Costs vary between different load classes. Since labor and coupling costs are similar for a given length of tray, the heavier classes are less cost-effective on a load length basis. The designer should therefore specify the lightest class of tray compatible with the weight requirements of the cable tray.

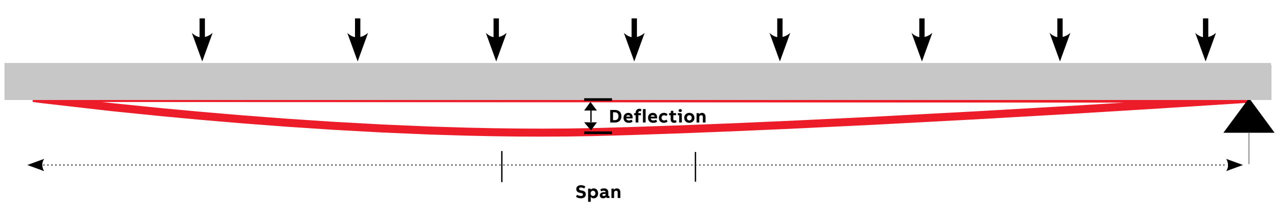
Table 1 – Span/load class designation – USA

Load		Span m (ft.)				
kg/m	(lb/ft.)	1.5 (5)	2.4 (8)	3.0 (10)	3.7 (12)	6.0 (20)
37	(25)	5AA	8AA	10AA	12AA	20AA
74	(50)	5A	8A	10A	12A	20A
112	(75)	–	8B	–	12B	20B
149	(100)	–	8C	–	12C	20C

NOTE: These ratings are also used in Mexico.

Table 1 – Span/load class designation – CANADA

Load		Span m (ft.)						
kg/m	(lb/ft)	1.5 (5)	2.0 (6.5)	2.5 (8.2)	3.0 (10)	4.0 (13)	5.0 (16.4)	6.0 (20)
37	(25)	–	–	–	A	–	–	–
45	(30)	–	–	A	–	–	–	–
62	(42)	–	A	–	–	–	–	–
67	(45)	–	–	–	–	–	–	D
82	(55)	–	–	–	–	–	D	–
97	(65)	–	–	–	C	–	–	–
99	(67)	A	–	–	–	–	–	–
112	(75)	–	–	–	–	–	–	E
113	(76)	–	–	–	–	D	–	–
119	(80)	–	–	C	–	–	–	–
137	(92)	–	–	–	–	–	E	–
164	(110)	–	C	–	–	–	–	–
179	(120)	–	–	–	D	–	–	–
189	(127)	–	–	–	–	E	–	–
259	(174)	C	–	–			–	–
299	(200)	–	–	–	E	–	–	–



Loading capacity

Cable loads
The cable load is the total weight, expressed in (lb/ft.), of all the cables that will be placed in the cable tray.

Snow loads
Depending on the area, snowfall could indicate an additional design load. If snowfall is a factor and the tray has a solid cover in outdoor installations, a minimum load of 5 lb (2.27kg). per square foot should be used.

Ice loads
If a cable tray system is subject to icing conditions, usually only the top surface or cover and the windward side will be coated with any significant amount. It is generally assumed that ice weighs 57 lb (25.85kg) per cubic foot.

Wind loads
All outdoor cable tray installations should factor in wind loads, especially the pressure exerted on side rails of ladder trays. There have also been instances of strong winds lifting covers off trays, which can be minimized with the use of wraparound cover clamps.

Concentrated loads

A concentrated static load is not included in Table 1 (following page). 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 on the centerline of the tray at midspan. When so specified, the concentrated static load may be converted to an equivalent uniform load (We) in kilograms/meter (pounds), using the following formula, and added to the static weight of cable in the tray:

$$We = \frac{2 \times (\text{concentrated static load, kg (lb)}}{\text{Span length, m (ft.)}}$$

This combined load may be used to select a suitable load/span designation. If the combined load exceeds the working load shown on the following page, the manufacturer should be consulted.

Effect of temperature

Strength properties of reinforced plastics are reduced when continuously exposed to elevated temperatures. Working loads shall be reduced based on table 2.

Table 2 – Effect of temperature

Temperature		Approximate % of strength	
(°C)	(°F)	Isophthalic polyester	Vinylester
23.8	75	100	100
37.7	100	90	100
51.6	125	78	100
65.5	150	68	90
79.4	175	60	90
93.3	200	52	75

NEMA Standard 8-10-1986.
If unusual temperature conditions exist, the manufacturer should be consulted.

Technical information

Thermal contraction and expansion

It is important that thermal contraction and expansion be considered when installing cable tray systems. The length of the straight cable tray runs and the temperature differential govern the number of expansion splice plates required (see Table 1 below).

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01 Typical cable tray installation

The cable tray should be anchored at the support nearest to its midpoint between the expansion splice plates and secured by expansion guides at all other support locations (see diagram 01). The cable tray should be permitted longitudinal movement in both directions from that fixed point.

Accurate gap setting at the time of installation is necessary for the proper operation of the expansion splice plates. The following procedure should assist the installer in determining the correct gap (see Figure 1):

1. Plot the highest expected tray temperature on the maximum temperature line.
2. Plot the lowest expected tray temperature on the minimum temperature line.
3. Draw a line between the maximum and minimum points.
4. Plot the tray temperature at the time of installation to determine the gap setting.

Figure 1 - Proper gap settings

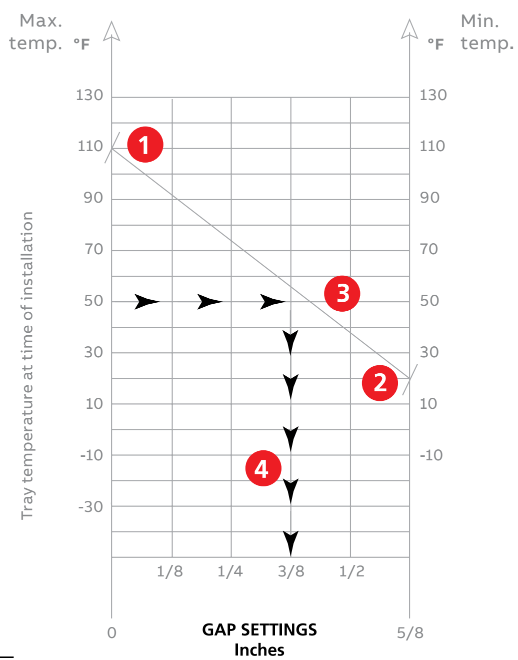

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Table 1 - Expansion or contraction for various temperature differences

Temperature differential		Max. distance between expansion connector* for 1" (25.4mm) expansion		Max. distance between expansion connector* for ⅝" (15.9mm) expansion	
°F	°C	(ft.)	(m)	(ft.)	(m)
14	25	667	203.3	417	127.1
28	50	333	101.5	208	63.3
42	75	222	67.6	139	42.3
56	100	167	50.9	104	31.7
70	125	133	40.5	83	25.2
83	150	111	33.8	69	21
97	175	95	28.9	59	17.9

NOTE: These ratings are also used in Mexico.

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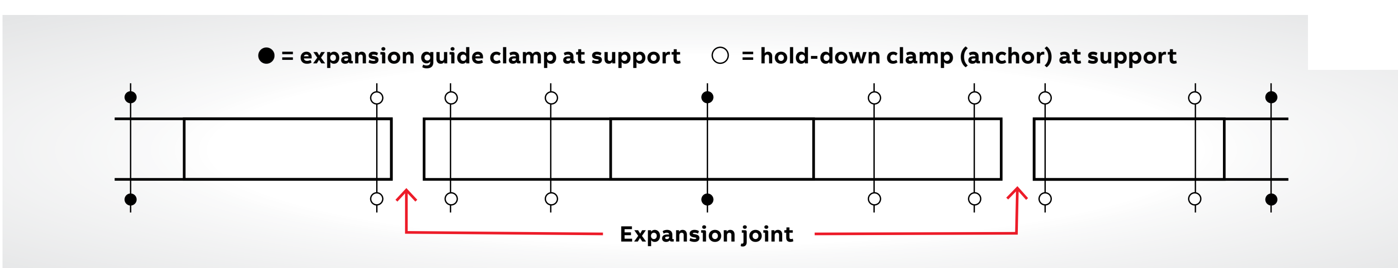


Technical information
Installation guidelines

Installation of T&B nonmetallic cable tray should be made in accordance with the standards set by the NEMA VE2 publication and CSA standards.

Always observe common safety practices when assembling tray and fittings. Installations generally require some field cutting. Dust created during fabrication presents no serious health hazard, but skin irritation may be experienced by some workers.

Operators of saws and drills should wear masks, long-sleeve shirts or coveralls.

Fabrication with nonmetallic cable tray is relatively easy and comparable to working with wood. Ordinary hand tools may be used in most cases.

Avoid excessive pressure when sawing or drilling. Too much force can rapidly dull tools and also produce excessive heat, which softens the bonding resin in the nonmetallic cable tray, resulting in a ragged edge rather than a clean-cut edge.

Field cutting is simple and can be accomplished with a circular power saw with an abrasive cut-off wheel (masonry type) or hack saw (24 to 32 teeth per inch).

Drill nonmetallic as you would drill hardwood. Standard twist drills are more than adequate. Any surface that has been drilled, cut, sanded or otherwise broken must be sealed with a compatible resin. Carbide-tipped saw blades and drill bits are recommended when cutting large quantities.

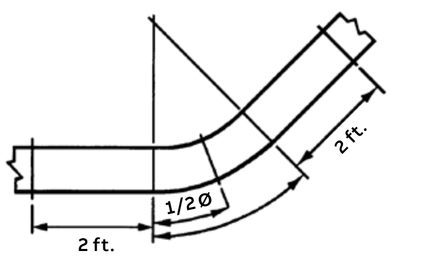
Support the nonmetallic cable tray material firmly during cutting operations to keep material from shifting, which may cause chipping at the cut edge.

Each tray section length should be equal to or greater than the support span. When possible, the splice should be located at quarter span.

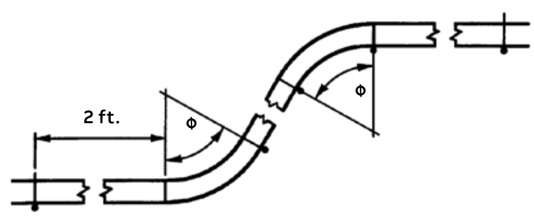
Fittings should be supported as per NEMA VE2.

Technical information
Cable tray support locations

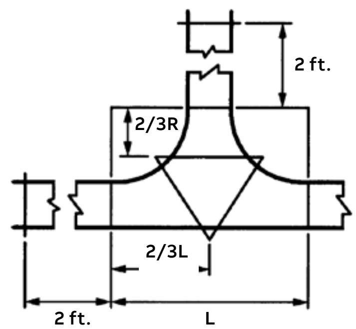
Horizontal elbow



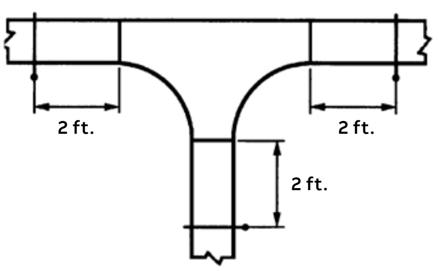
Vertical elbow



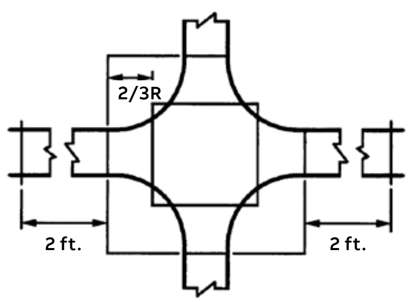
Horizontal tee



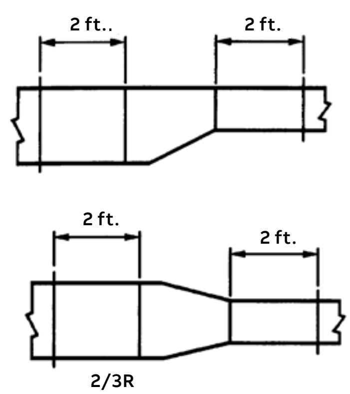
Horizontal wye



Horizontal cross



Horizontal reducer



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*NOTE: ø = 30°, 45°, 60°, 90° (degree of fitting)

FRP Cable Tray specifications
External revision 1

*Dimension Conversion Table:
2" = 50.8mm
3" = 76.2mm
4" = 101.6mm
5" = 127mm
7" = 177.8mm
6" = 152.4mm
8" = 203.2mm
9" = 228.6mm
9.25" = 235mm
12" = 304.8mm
18" = 355.6mm
18.5" = 470mm
24" = 457.2mm
30" = 762mm
36" = 914.4mm
42" = 1,066.8mm

Section 1 - Acceptable manufacturers

1.01 Cable tray system will be made of straight sections, fittings and accessories as defined in the latest CSA/NEMA standards publication.

1.02 All manufacturing practices will be in accordance with CSA/NEMA.

1.03 Cable trays will be by ABB, or approved CSA/NEMA member.

Section 2 - Cable tray design

2.01 Straight section structural elements; side rails, rungs and splice plates shall be pultruded from glass fiber reinforced polyester or vinylester resin.

2.02 Pultruded shapes will be constructed with a surface veil to ensure a resin-rich and ultravioletresistant surface.

2.03 Pultruded shapes shall meet the ASTM E-84 Class 1 flame rating and self-extinguishing requirements of ASTM D-635.

Section 3 - Construction

3.01 Straight section lengths will be 120" (10 ft. (3.05m)) or 240" (20 ft. (6.10m)) standard.

3.02 Side rails will be inward “C” configuration and be predrilled to accept splice plates.

3.03 Overall heights shall be 8, 6, 4 or 3" (*mm) respectively.

3.04 Loading depths for cable tray systems shall be 7, 5, 3 or 2" (*mm) as per CSA/NEMA tolerances.

3.05 Loading classifications and test specimens shall be per CSA/NEMA.

3.06 Rung spacing shall be 6, 9.25, 12 or 18.5" (*mm)

Section 4 - Dimensions

4.01 All fittings shall be of mitered design type with a minimum 3" (76.2mm) tangent following the radius.

4.02 All fittings shall have a nominal 9.25" rung spacing.

4.03 Width (usable inside tray width) shall be 6, 9, 12, 18, 24, 30 or 36" (*mm).

4.04 Outside width shall not exceed inside width by more than a total of 2" (50.8mm).

4.05 Straight and expansion splice plates will be of stainless steel or fiberglass design with an eight-bolt pattern in 5" (127mm) fill systems and four-bolt pattern for 3, 4, 6 and 8" tray depths.

4.06 Dimension tolerances will be per CSA/NEMA.

4.07 Cable tray must have integral connection between side rails and rungs consisting of nonmetallic mechanical fasteners and adhesive bonding.