

Cable Tray Installation Guide

Installation of B-Line fiberglass cable tray should be made in accordance with the standards set by NEMA Publication VE-2, Cable Tray Installation Guide, and National Electrical Code, Article 318.

- 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 fiberglass 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 fiberglass 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 fiberglass as you would drill hard wood. 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. (see page 351)
- Carbide tipped saw blades and drill bits are recommended when cutting large quantities.
- Support the fiberglass 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 FG-1.

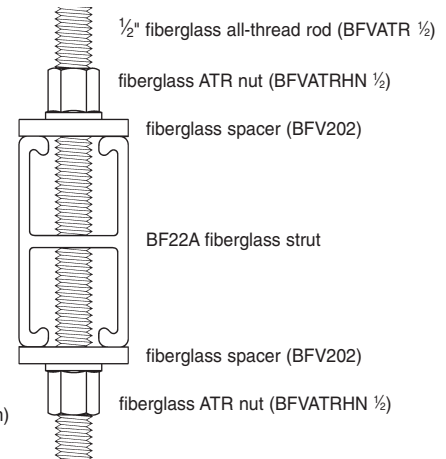
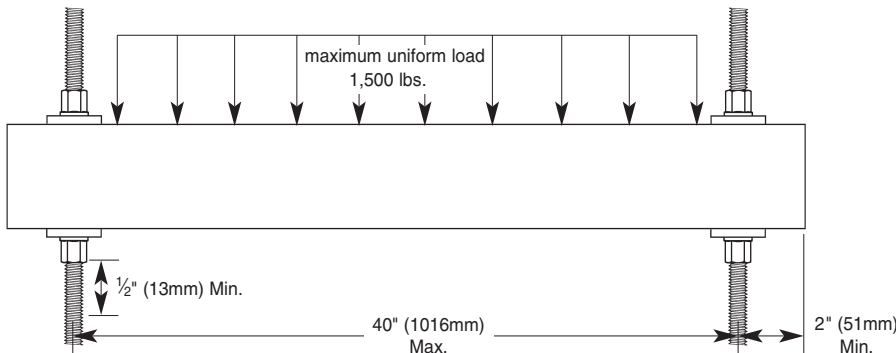
Recommended Fiberglass Trapeze Hanging Systems

Notes:

- 1) A snug three to four ft.-lbs. torque is sufficient for all thread rod nuts.
- 2) When supporting cable tray, the spacing between each trapeze should not exceed the distance between splice plates.
- 3) When hanging from beam, B-Line BFPU751 series clamps provide extra thread engagement necessary for load ratings. All thread rod must be fully engaged in the clamp.
- 4) Design load safety factor is 3:1

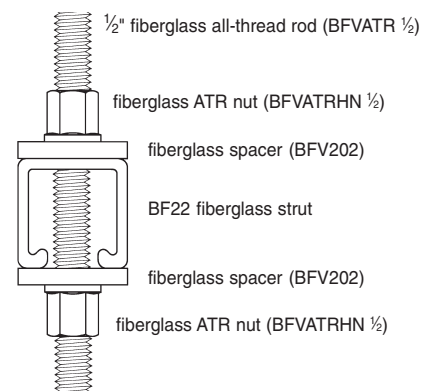
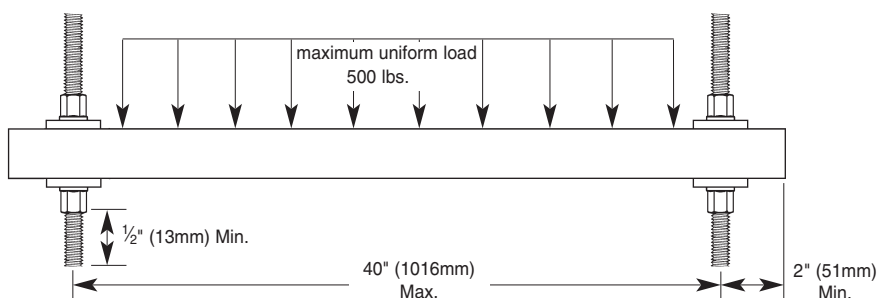
BF22A Strut:

2" max between material being supported and rod



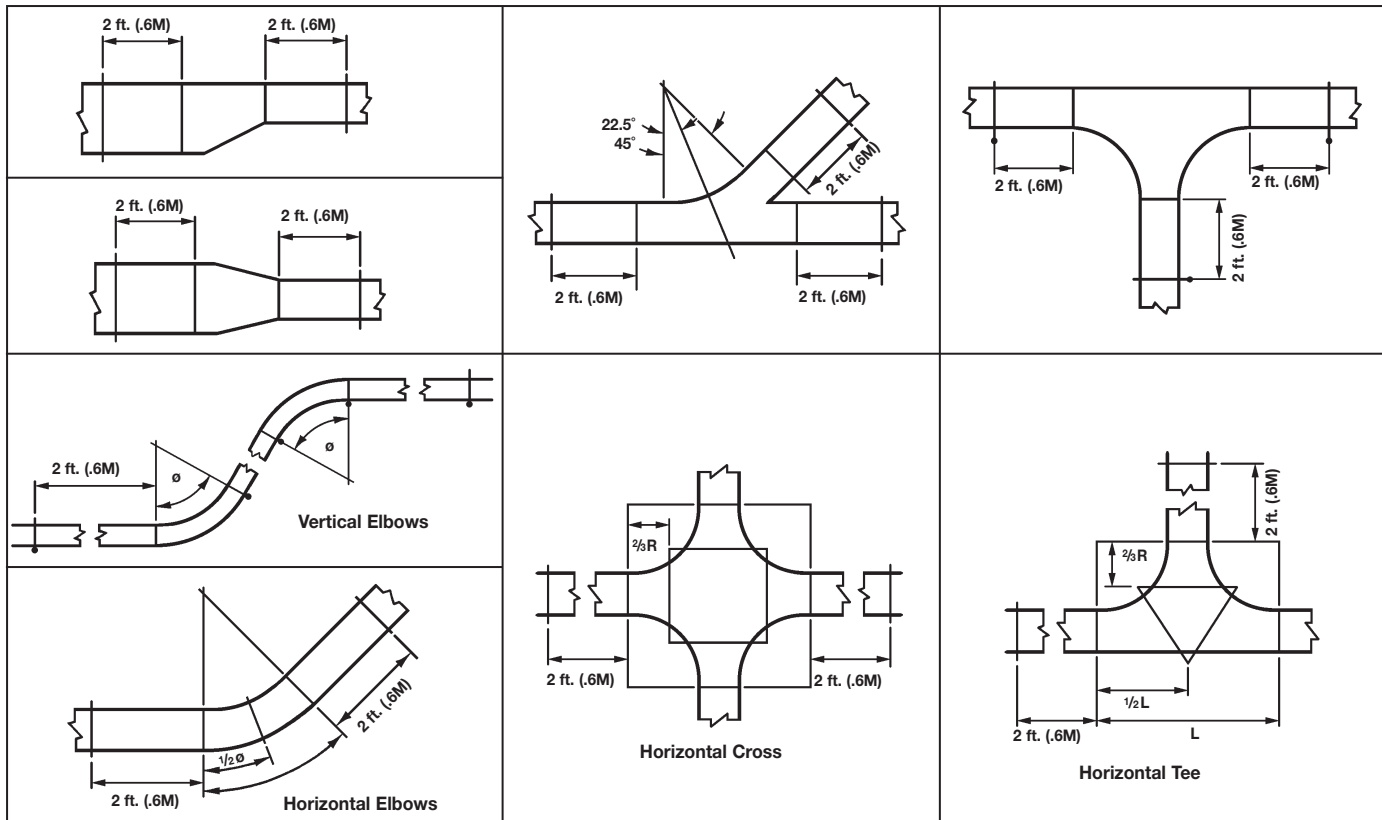
BF22 Strut:

2" max between material being supported and rod



Cable Tray Support Locations For Fittings

per NEMA VE-2 Installation Guide



$\emptyset = 30^\circ, 45^\circ, 60^\circ, 90^\circ$

How To Size Cable Tray

Based on the National Electrical Code - 1993, Section 318

The National Electrical Code Article 318 was written primarily for verifying the cable fill in cable trays but little has been done to convert this information into a design procedure.

In the development of a complete cable tray support system, B-Line established a simple method of determining the right size tray to support any given amount of cables. The following tables cover our method for determining cable tray widths based on tray design and system voltage.

Table I

Table I is subdivided into two categories covering electrical service of 2000 volts or less. The first, Category A, is for any mixture of power or lighting cables with any mixture of control or signal cables. Category B is used when control and/or signal cables only are being used.

Control Circuit - the circuit of a control apparatus or system that carries the electric signals directing the performance of the controller, but does not carry the main power (NEC Article 100).
Signaling Circuit - any electric circuit that energizes signaling equipment (NEC Article 100).

Table II

Table II has only one category of electrical service and that is 2001 volts and over for types MV and MC cables both single and multiconductor. Type MV is a single or multiconductor solid dielectric insulated cable rated 2001 volts or higher (NEC Article 326).

Type MC cable is a factory assembly of one or more conductors, each individually insulated and enclosed in a metallic sheath or interlocking tape, or a smooth or corrugated tube (NEC Article 334). Cables other than Types MV and MC can be installed provided they are "specifically approved for installation in cable trays."

Table III

Table III covers 3, 4 and 6 inch ventilated cable channels.

Tray Sizing Procedure		
Step 1. Select proper cable tray table below based on cable voltage and tray type.		
Cable Voltage	Cable Tray Type	Use:
2000 Volts or less	Ladder, Cable Tray	Table I
2001 Volts or more	Ladder, Cable Tray	Table II
2001 Volts or less	Cable Channel, ventilated	Table III

How To Size Cable Tray

Tables I - Ladder Cable Tray - for cables rated 2000 volts or less

For power or lighting or any mixture of power, lighting, control or signal cables:

1. Multiconductor Cable

Conductor sizes 4/0 and larger*	tray width \geq Sd	NEC 318-9(a) (1)
Conductor sizes 3/0 and smaller	tray width \geq 0.857 Sa	NEC 318-9(a) (2)

Example: Calculate width of cable tray required for the following Type TC Cables.

6	4/c	500 kcmil	Power:	Diameter = 3.14	6 x 3.14 = 18.84
21	4/c	#8 AWG	Lighting:	Area = 0.407	.857 (21 x 0.407) = 7.32
20	5/c	#12 AWG	Control:	Area = 0.170	.857 (20 x 0.170) = 2.91
					29.07

Solution: Use 30 inch wide tray

2. Single Conductor Cable

Conductor sizes 250 MCM thru 900 MCM† only	tray width \geq 0.023 Sa*	NEC 318-10(a) (2)
Conductor sizes 3/0 and smaller	tray width \geq 0.857 Sa	NEC 318-10(a) (4)

Example: Calculate width of cable tray required for the following Type THW Wires.

6	1/c	4/0 AWG	Power:	Diameter = 0.710	(6 x 0.71) = 4.26
9	1/c	500 kcmil	Power:	Area = 0.83	.923 (9 x 0.83) = 6.89
6	1/c	250 kcmil	Power:	Area = 0.49	.923 (6 x 0.49) = 2.71
					13.86

Solution: Use 18 inch wide tray

3. Mixture of Single and Multiconductor Cable

Example: Calculate width of cable tray required for the following mix of cables. Use guidelines from (1) & (2) above.

2	3/c	250 kcmil	Type MC	Power:	Diameter = 1.84	2 x 1.84 = 3.68
12	4/c	#8 AWG	Type TC	Lighting:	Area = 0.41	.857 (12 x 0.41) = 4.22
60	4/c	#12 AWG	Type TC	Control:	Area = 0.12	.857 (60 x 0.12) = 6.17
4	1/c	1/0AWG	Type THW	Power:	Diameter = 0.55	(4 x 0.55) = 2.20
6	1/c	500kc mil	Type THW	Power:	Area = 0.83	.923 (6 x 0.83) = 4.60
					20.87	

Solution: Use 24 inch wide tray

For control and/or signal duty cable only:

1. Multiconductor Cable

$$\text{tray width} \geq \frac{2Sa}{D} \quad \text{NEC 318-9(b)}$$

All conductor sizes**

Example: Calculate width of cable tray required for the following Type TC Cables in 4 inch deep tray.

24	16/c	16 AWG	Control:	Area = 0.29	2(24 x 0.29) ÷ 4 = 3.48
42	4/c	12 AWG	Control:	Area = 0.13	2(42 x 0.13) ÷ 4 = 2.73
18	4/c	10 AWG	Control:	Area = 0.20	2(18 x 0.20) ÷ 4 = 1.80
					8.01

Solution: Use 24 inch wide tray

* The 4/0 and larger cable shall be installed in a single layer and no other cables shall be placed on them.

** For computation only depth D can not exceed 6 inches.

† For 1000 MCM and larger single conductor cable, refer to NEC 318-10(a)1 for sizing information.

Sd = the sum of the diameters, in inches, of all cables in the same ladder cable tray.

Sa = the sum of the cross-sectional areas, in square inches, of all cables in the same ladder cable tray.

How To Size Cable Tray

Table II - Ladder - for cables rated 2000 volts or less

For MV or MC cables:

1. Mixture of Single and Multiconductor Cable

NEC 318-12

All conductor sizes† tray width \geq Sd

Example: Calculate width of cable tray required for the following cables.

4	1/c	500 kcmil	Type MV	Diameter =	1.05	$4 \times 1.05 = 4.20$
10	3/c	2/0 AWG	Type MC	Diameter =	1.55	$10 \times 1.55 = 15.50$
4	3/c	4/0 AWG	Type MV	Diameter =	1.78	$4 \times 1.78 = 7.12$
						26.82

Solution: Use 30 inch wide tray

Table III - Cable Channel, Ventilated - for cables rated 2000 volts or less

For power, lighting, control and/or signal duty cables:

1. Multiconductor Cable (all size cables)

NEC 318-9(E)

	3 inch wide	4 inch wide	6 inch wide
One cable only	$S_a \leq 2.3 \text{ in}^2$	$S_a \leq 4.5 \text{ in}^2$	$S_a \leq 7.0 \text{ in}^2$
Two or more cables	$S_a \leq 1.3 \text{ in}^2$	$S_a \leq 2.5 \text{ in}^2$	$S_a \leq 3.8 \text{ in}^2$

Example: Calculate width of cable channel required for the following Type TC Cables.

1	3/c	1/0 AWG	Area = 1.17 which is less than 1.3. Use 3 inch wide.
1	4/c	300 kcmil	Area = 3.77 which is less than 4.5. Use 3 inch wide.
6	4/c	#10 AWG	Area = $6 \times 0.20 = 1.20$ which is less than 1.3. Use 3 inch wide.
2	3/c	1/0 AWG	Area = $2 \times 1.17 = 2.34$ which is less than 2.5. Use 4 inch wide.

2. Single Conductor (1/0 AWG or larger)

NEC 318-10(b)

	3 inch wide	4 inch wide	6 inch wide
Any number of cables	$S_d \leq 3.0$	$S_d \leq 4.0$	$S_d \leq 6.0$

Example: Type THW Cables.

3	1/c	500 kcmil	Type THW	Diameter = $3 \times 1.029 = 3.09$ which is less than 4.0. Use 4 inch wide.
8	1/c	4/0 kcmil	Type THW	Diameter = $8 \times 0.71 = 5.68$ which is less than 6.0. Use 6 inch wide.

† Cables shall be installed in a single layer. Where single conductor cables are triplexed, quadruplexed or bound together in circuit groups, the sum of the diameters of the single conductors shall not exceed the cable tray width and these groups shall be installed in single layer arrangement.

Sd = the sum of the diameters, in inches, of all cables in the same ladder cable tray.

Sa = the sum of the cross-sectional areas, in square inches, of all cables in the same ladder cable tray.

Covers (Derating)

When cable trays are continuously covered for more than six feet with solid unventilated covers, the ampacity of the installed cables must be reduced per NEC-1993.

2000 volts or less

- MULTICONDUCTOR CABLES
 - use 95% of tables 310-16 and 310-18
- SINGLE CONDUCTOR CABLES
 - 600 MCM and larger use 70% of tables 310-17 and 310-19
 - 1/0 AWG thru 500 kc mil use 60% of tables 310-17 and 310-19

2001 volts and over

- MULTICONDUCTOR CABLES
 - use 95% of tables 310-75 and 310-76
- SINGLE CONDUCTOR CABLES
 - use 70% of tables 310-69 and 310-70

Cross-Sectional Area

Rarely is the cross-sectional area of a multiconductor cable given in manufacturers literature or the National Electrical Code. To calculate the cross-sectional area simply square the diameter and multiply by 0.7854. The diameter used in the calculations is the overall outside diameter (O.D.) of the cable including insulation and/or armor.

Cross Sectional Area (Square Inches) = $0.7854 (\text{O.D.})^2$

Multipliers Used in Tables

The multipliers used in all tables are mathematical equivalents of Tables 318-9 and 318-10 of the National Electrical Code-1993.

An example can be found in column 1 of Table 318-9. The proportion of cable tray width (size inches) to allowable fill (seven square inches) is 0.857 for 3/0 and smaller multiconductor cables in ladder type trays. Therefore the product of 0.857 and the cross-sectional area of cables is the tray width.