



**LIBERTY
PULTRUSIONS**

FRP COMPOSITE STRUCTURALS

TECHNICAL DATA GUIDE

"Superior Composites for Superior Products"

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TECHNICAL DATA

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TECHNICAL DATA

Good Reasons to Specify Liberty Pultrusions Composite Structural

Liberty Pultrusions FRP Composite structural shapes are manufactured by the pultrusion process. The pultrusion process permits the strategic placement of continuous strand glass fiber, fiberglass mats and C/W Barrier allowing for optimization of structural properties. Liberty Pultrusions FRP pultruded structurals incorporate features that translate into benefits for end users, fabricators and erectors.

CHEMICAL & CORROSION RESISTANT

Liberty Pultrusions fiberglass reinforced polymer (FRP) Composite structurals with a combination of UV inhibitor and C/W Barrier remain virtually unaffected in many chemical environments. Liberty Pultrusions structurals have a superior long term resistance to chemical and other corrosive conditions. They will not rust, rot, scale, or mildew.

These structural shapes are commonly specified by engineers and industrial designers for use as supports for FRP roofing and siding and as components in corrosive environments such as metal processing, wastewater treatment, pulp and paper, petrochemical, mining, etc. In many cases, they have replaced more conventional materials which have proven to be costly and ineffective in corrosive environments.

Liberty Pultrusions structurals are produced utilizing a premium grade isophthalic fire-rated resin which is superior in corrosion resistance to general purpose resin systems. Vinyl ester resin systems are also available for specific conditions.

HIGH STRENGTH

Liberty Pultrusions structurals are strong, durable, and have a high strength to modulus ratio. Liberty Pultrusions structurals are particularly effective in high impact conditions and repeated (cyclic) loadings associated with wind storms.

FIRE RETARDANT

Liberty Pultrusions manufactures Liberty Pultrusions structurals with a fire retardant resin system.

Liberty Pultrusions FRP structurals have a flame spread rating of 25 or less when tested per ASTM E-84. Polyester "Polyglas F" and vinyl ester "Polyglas C" both provide this rating for use as structural supports, purlins and girts.

GOOD WEATHERING CHARACTERISTICS

Liberty Pultrusions structurals have "built-in" ultraviolet and weather protection. There is no need to apply costly coatings or films. The combination of four decades of production experience, quality resin components, and – more recently – C/W Barrier protection, combine to yield uniquely durable structural shapes.

VERSATILE

Liberty Pultrusions offers a wide range of manufacturing and technical capabilities to meet specific needs. Liberty Pultrusions structurals are available in both polyester and vinyl ester resin formulations combined with engineered glass fiber architecture. These materials are configured to meet various functional requirements. Liberty Pultrusions FRP structurals are adaptable to many building applications as supports for roof and wall panels; as structural components in corrosive environments; and are easily installed using conventional construction methods.

Liberty Pultrusions structurals are
available in the following resin systems:

Polyglas F: Fire Retardant, Polyester, Gray Color
Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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TECHNICAL DATA

Designing Liberty Pultrusions FRP Composite Structural

DESIGN VERSATILITY

Liberty Pultrusions FRP Structural are designed to meet a wide variety of structural as well as environmental considerations. All Liberty Pultrusions structural shapes are produced using uni-directional fiberglass roving, which provides longitudinal strength, multi-directional fiberglass mat, which provides lateral reinforcement, and C/W Barrier, which provides a resin rich surface for chemical and corrosion resistance.

Fiberglass reinforced structural shapes are generally designed using traditional structural analysis methods such as are used for steel shapes. FRP structural shapes have a much higher strength to weight ratio than steel. However, special design considerations must be given when designing FRP structural shapes. These design considerations are necessary to account for the non-homogeneous and non-isotropic nature of FRP composite structurals produced by the pultrusion process. Virtually unlimited shape configuration availability, variations in the manufacturing process, and differences in material properties also make FRP composite structural design different than steel.

DEFLECTION AND DEFLECTION LIMITS

Determining the maximum deflection of an FRP composite structural shape under load is accomplished by using traditional beam equations and adding another component of deflection due to shear. Shear deflection occurs in materials that have a low Shear Modulus when compared to steel. Deflections due to shear can be significant for FRP composite structurals, and can increase the traditionally calculated values up to 10%. The span tables contained in this data guide account for the additional deflection due to shear.

The recommended deflection limit for FRP composite structural roof purlins is L/180. This corresponds favorably with the traditional deflection limits of L/180 and L/240 generally specified for steel shapes. Although FRP composite structurals perform well with much less stringent deflection limits, the L/180 limit is recommended in order to prevent ponding of water in low slope roof applications.

The recommended deflection limit for FRP composite wall girts is L/120. While this is less than the traditional deflection limits of L/180 and L/240 generally specified for steel shapes, it is used to take advantage of the resilient, flexible properties of FRP composite structurals and panels.

FLEXURAL STRENGTH

The flexural strength of FRP structurals is dependent on shape configuration and the spacing of lateral bracing. The span tables contained in this data guide list the load carrying capacity of the Liberty Pultrusions structural shapes in unbraced, fully braced, and braced at mid-span conditions. Load carrying capacity of the structural shapes will vary for other braced conditions. Please contact Liberty Pultrusions Engineering for additional information.

NONENCLATURE FOR SECTION PROPERTY TABLES AND LOAN/SPAN TABLES

A	= Cross sectional area (in ²)
a	= Flange width of a flanged channel (in)
A _w	= Area of web (in ²)
b	= Width of section (in)
b _f	= Width of flange (in)
d	= Depth of section (in)
D	= Outside diameter (in)
F _b	= Maximum allowable stress in bending (psi)
F _v	= Maximum allowable stress in shear (psi)
I	= Moment of inertia (in ⁴)
J	= Torsional constant (in ⁴)
r	= Radius of gyration (in)
S	= Section modulus (in ³)
S _b	= Section modulus to the bottom (in ³)
S _{min}	= Minimum section modulus (in ³)
S _t	= Section modulus to the top (in ³)
t	= Thickness (in)
t _b	= Thickness of the width dimension (in)
t _d	= Thickness of the depth dimension (in)
t _f	= Thickness of flange (in)
t _w	= Thickness of web (in)
w	= Total width of a flanged channel (in)
x	= Distance from the outermost fibers to the Y-Y axis
y	= Distance from the outermost fibers to the X-X axis

Liberty Pultrusions structurals are available in the following resin systems:

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Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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**Designing Liberty Pultrusions
FRP Composite Structural (con't)**

SUSTAINED ELEVATED TEMPERATURE USAGE

Sustained elevated temperatures can reduce the mechanical properties of FRP composite structurals and must be considered in structural design. This estimated retention of these properties as related to temperature is listed below.

Sustained Ambient Temperature	Liberty Pultrusions Polyglas F & Polyglas M (Polyester Resin)	Liberty Pultrusions Polyglas C (Vinyl ester resin)
	100%	100%
100F	100%	100%
120F	83%	95%
140F	67%	83%
160F	Not Recommended	72%
180F	Not Recommended	61%
200F	Not Recommended	50%

The span tables contained in this data guide do not account for sustained elevated temperature usage of FRP structural shapes. Please contact Liberty Pultrusions Engineering for further information.

FACTORS OF SAFETY

It is recommended that the following factors of safety be used for FRP structural design:

Flexural Strength	2.5
Shear Strength	3.0
Compressive Strength	3.0
Tensile Strength	3.0
Bearing Strength	4.0
Connections	4.0

MINIMUM EDGE DISTANCE AND FASTENER SPACING

It is recommended that the following minimum edge distances and fastener spacings be used for FRP structurals:

Edge Distance (end)	3.0 X Fastener Diameter
Edge Distance (side)	2.0 X Fastener Diameter
Spacing	5.0 X Fastener Diameter

MANUFACTURING TOLERANCE

Liberty Pultrusions Structural are manufactured per ASTM D 3917, Standard Specification of Thermosetting Glass-Reinforced Polymer Pultruded Shapes.

FLAME SPREAD

Liberty Pultrusions Polyglas F and Liberty Pultrusions Polyglas C have a flame spread rating of 25 or less when tested per ASTM E-84.

Liberty Pultrusions advises that the numerical flame spread classification is not intended to reflect hazards presented by this or any other material under actual fire conditions.

STORAGE AND HANDLING

Storage and handling of pultruded structural shapes shall be done in a manner to protect against physical damage and premature contact with moisture and UV radiation. All pultruded structural shapes shall be stored to prevent breakage, cuts, cracks, bends, twists, and dents. It is recommended that the pultruded structural shapes be stored above ground and covered with a waterproof, opaque material.

PRODUCT SELECTION

When choosing Liberty Pultrusions FRP composite structurals, consider selecting stock shapes, since they may be more readily available and economical.

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1810 Diamond Street • San Marcos, CA 92069 • Phone 760.744.6371 • Fax 760.744.0201**TECHNICAL DATA****Corrosion &
Weathering Guide****CHEMICAL AND CORROSION RESISTANT**

Since the 1960's fire retardant polyester resins have been used for FRP Composite structurals in corrosive atmospheres. There are many resin systems available having varying degrees of corrosion resistance. Based on required characteristics and the intended use, Liberty Pultrusions established guidelines to select the optimal resin system. First, the resin system should be flame resistant and be able to meet Class 1 flame spread ratings. Second, it should perform in all types of severe weather conditions. And third, it must be resistant to a host of various chemical and corrosive elements. These criteria must be satisfied while maintaining an inherent toughness and an ability to meet the stringent loading requirements of the major building codes.

Premium grade isophthalic polyester resins have some major advantages for corrosion protection over general purpose polyester resins. Some of the major advantages are:

- higher heat resistance
- greater retention of physical properties
- better chemical resistance
- better adhesion to the fiberglass reinforcements

In laboratory tests, isophthalic polyester resin systems showed 10% higher flexural and 20% higher tensile properties. Liberty Pultrusions premium grade isophthalic polyester resin system is the ideal solution for Liberty Pultrusions FRP Composite structurals.

Vinyl ester resins are another possible choice. They have good corrosion resistant qualities, in some environments better than polyester resins, and may perform better at slightly higher temperatures. All vinyl ester resin systems, however, have one major drawback: they have poor resistance to UV and will weather very quickly. Vinyl ester resin is not recommended for use in exterior application where color retention is important.

WEATHERABILITY

Liberty Pultrusions realized early on that weathering, mainly UV degradation, was a major factor that impacted the quality and long term performance of its products. For decades, Liberty Pultrusions has been in the forefront of providing solutions to this difficult problem. Liberty Pultrusions was one of the first FRP producers to utilize SFTS (South Florida Testing Service), an internationally recognized environmental testing company, to evaluate long term outdoor performance. Liberty Pultrusions has also conducted its own outdoor weather testing for over 45 years.

In addition, Liberty Pultrusions Research and Development Staff utilizes a Xenon-Arc Weatherometer. This device provides comparable natural outdoor weathering correlation at an accelerated rate. Liberty Pultrusions is able to evaluate the latest resins, pigments, reinforcements and additives in as little as nine months instead of the standard three years required by traditional outdoor test methods.

C/W BARRIER

To further enhance corrosion and weathering performance, a C/W Barrier is incorporated by Liberty Pultrusions. C/W Barrier is a protective layer that is fused into the resin/fiberglass matrix to give Liberty Pultrusions structurals even greater protection against degradation. C/W Barrier is standard on all Liberty Pultrusions FRP Composite structurals.

THE SUPERIOR SOLUTION

Over 45 years of FRP evaluation and testing has led Liberty Pultrusions to the fire retardant isophthalic polyester resin system currently utilized. This system, with UV stabilizers and C/W Barrier provides the best combination of performance characteristics for Liberty Pultrusions FRP structurals.

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TECHNICAL DATA

CHEMICAL & CORROSION RESISTANCE GUIDE

Chemical Environment	Concentration Percent	Temperature (°F)	
		Polyester	Vinyl Ester
Acetic Acid	10	150	210
	25	125	210
	50	90	180
Alum	Sat'd	250	210
Alum, Potassium	All	160	210
Aluminum Chloride	All	120	210
Aluminum Fluoride ¹	All	90	90
Aluminum Potassium Sulfate	All	160	210
Aluminum Sulfate	All	250	210
Ammonia, Dry & Wet	Gas	90	100
Ammonium Hydroxide	10	90	160
Ammonium Nitrate	Sat'd	200	210
Ammonium Sulfate	Sat'd	200	210
Anaerobic Sewage	-	85	85
Arsenic Acid	19°Be	180	180
Benzene	100	90	NR
Benzene Sulfonic Acid	30	180	210
Benzoic Acid	Sat'd	250	210
Boric Acid	Sat'd	180	210
Bromine, Dry & Wet Gas	100	90	90
Butyric Acid	70	150	160
	160	160	180
Calcium Hypochlorite	Sat'd	100	160
Carbon Dioxide, Wet, Acidic	100	250	210
Carbon Monoxide Gas	100	200	210
Carbon Tetrachloride, Vapor	100	90	90
Carbonic Acid	Sat'd	160	90
Chlorine Gas, Dry	100	200	180
Chlorine, Wet Gas	100	90	-
Chlorine Cell Plant Roofing & Siding	Fumes	90	120
Citric Acid	Sat'd	200	210
Cooling Towers	-	90	90
Copper Sulfate	Sat'd	250	210
Diesel Fuel	100	100	175
Ethylene Glycol	All	250	210
Fatty Acids	Sat'd	250	210
Fertilizer Fumes	-	100	120
Flue Gas @ 340°F	-	180	-
Fluoboric Acid ¹	10	180	210
	Sat'd	90	180
Fluosilicic Acid ¹	25	90	120
Formic Acid	50	90	120
Gluconic Acid	50	120	100
Glycolic Acid	70	120	100
Hydrobromic Acid	25	160	200
Hydrochloric Acid ¹	20	230	200
	36	90	150

Corrosion Weathering Guide

Chemical Environment	Concentration Percent	Temperature (°F)	
		Polyester	Vinyl Ester
Hydrocyanic Acid	Sat'd	200	150
Hydrofluoric Acid ¹	15	100	100
Hydrofluosilicic Acid ¹	10	100	150
Hydrogen Chloride, Anhydrous	100	250	-
Hydrogen Fluoride, Wet ¹	100	90	90
Hydrogen Sulfide	All	250	210
Hypochlorous Acid	Conc.	90	90
Kerosene	100	120	175
Lactic Acid	All	200	210
Lime Slurry	Sat'd	180	170
Magnesium Chloride	Sat'd	220	210
Mercury	100	250	210
Mineral Oils	100	180	200
Naphtha	100	200	180
Nitric Acid	10	175	120
Nitric Acid Vapor	60	95	160
Nitrous Acid	10	90	90
Oleic Acid	100	200	200
Oxalic Acid	All	220	210
Palmitic Acid	Sat'd	160	210
Phosphoric Acid	85	220	210
Picric Acid	10	100	90
Potassium Aluminum Sulfate	Sat'd	160	210
Potassium Sulfate	All	200	210
Sewage, Municipal, Treated & Untreated	-	90	90
Sodium Bicarbonate	Sat'd	140	160
Sodium Bisulfate	All	200	210
Sodium Carbonate	Sat'd	90	160
Sodium Chloride	Sat'd	200	210
Sodium Hydroxide	5	180	180
Sodium Nitrate	Sat'd	220	210
Sodium Sulfate	All	180	210
Stearic Acid	All	200	210
Sulfamic Acid	Sat'd	160	210
Sulfite Liquors	-	160	210
Sulfuric Acid	50	200	210
	70	150	200
Sulfuric Acid Vapor	80	140	210
Sulfurous Acid	10	90	100
Tannic Acid	Sat'd	200	210
Toluene	100	90	NR
Trichloroacetic Acid	50	90	210
Turpentine, Pure Gum	100	90	90
Urea	Sat'd	90	180
Waste Water Treatment	-	100	150
Zinc Sulfate	All	200	210

1. C/W Barrier is standard on all Liberty Pultrusions FRP Composite Structurals for optimum performance. The use of C/W Barrier enhances performance in all environments.
2. These recommendations are for vapor, mist, condensate and splash conditions.
3. This information is offered as a corrosion resistance guide to design engineers, plant engineers and others who are responsible for selecting FRP structural components. Since conditions vary from project, this data is offered as a guide and should not be construed as a guarantee.
4. This guide is for Liberty Pultrusions pultruded structural shapes only.
5. Temperature data is not necessarily the maximum service temperature. It is the upper temperature at which the resin has been tested, used or evaluated. The resin may be suitable for higher temperature operation but additional information or testing would be required.





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**Liberty Pultrusions FRP
Structurals - Availability**


	WIDE FLANGE BEAMS
	3 x 3 x 1/4 4 x 4 x 1/4 6 x 6 x 1/4 6 x 6 x 3/8 8 x 8 x 3/8


	EQUAL LEG ANGLE
	1 x 1 x 1/8 1 1/4 x 1 1/4 x 1/8 1 1/4 x 1 1/4 x 3/16 1 1/2 x 1 1/2 x 1/8 1 1/2 x 1 1/2 x 3/16 1 1/2 x 1 1/2 x 1/4 2 x 2 x 3/16 2 x 2 x 1/4 3 x 3 x 1/4 3 x 3 x 3/8 4 x 4 x 1/4 4 x 4 x 3/8 4 x 4 x 1/2 6 x 6 x 3/8 6 x 6 x 1/2

	I BEAMS
	3 x 1 1/2 x 1/4 4 x 2 x 1/4 6 x 3 x 1/4 6 x 3 x 3/8 6 x 4 x 3/8 8 x 4 x 3/8 10 x 8 x 1/2 x 3/8

	CHANNEL
	2 x 13/16 x 1/8 2 x 1 x 3/16 2 x 1 x 1/4 2 3/4 x 1 x 1/8 3 x 3/4 x 1/8 3 x 7/8 x 1/4 3 x 1 x 3/16 3 x 1 1/2 x 1/4 3 x 1 7/8 x 3/16 3 1/4 x 1 5/8 x 1/8 3 1/2 x 1 3/16 x 1/8 x 3/16 4 x 1 1/16 x 1/8 4 x 1 1/8 x 1/4 4 x 1 3/8 x 3/16 4 x 3 x 1/2 4 1/8 x 1 13/16 x 3/8 x 1/4 4 3/4 x 1 5/8 x 3/16 5 x 1 3/8 x 1/4 6 x 1 5/8 x 1/4 6 x 2 x 1/4 7 3/4 x 1 3/4 x 1/4 8 x 2 3/16 x 3/8 8 1/2 x 2 11/16 x 3/16 10 x 2 3/4 x 1/2 11 1/4 x 1 5/8 x 3/8 20 x 2 x 1/4

	UNEQUAL LEG ANGLE
	2 x 1 x 1/4 2 x 1 7/8 x 1/2 2 1/4 x 1 1/2 x 3/16 2 9/16 x 1 11/16 x 3/16 2 3/4 x 2 x 1/4 3 x 2 x 3/8 4 x 2 1/2 x 1/4 6 x 1 3/4 x 3/8 6 x 2 x 1/4 6 x 3 x 1/4 6 x 3 x 3/8 6 x 4 1/2 x 1/2

	SQUARE TUBING
	1 x 1 x 1/8 1 1/2 x 1 1/2 x 1/8 1 1/2 x 1 1/2 x 1/4 1 3/4 x 1 3/4 x 1/4 2 x 2 x 1/8 2 x 2 x 1/4 3 x 3 x 1/4 4 x 4 x 1/4

	RECTANGULAR TUBING
	4 x 1 x 3/16 x 3/16 4 x 2 x 1/8 x 1/4 4 3/4 x 1 3/4 x 3/16 5 x 3 x 3/4 5 1/8 x 2 1/8 x 3/16 x 3/16 6 1/2 x 2 x 1/4 x 1/2

Liberty Pultrusions structurals are available in the following resin systems:

Polyglas F: Fire Retardant, Polyester, Gray Color
 Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
 Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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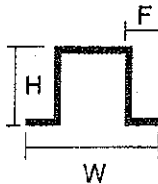
**Liberty Pultrusions FRP
Structurals - Availability**



ROUND TUBING

- 1 x 1/8
- 1 1/4 x 1/8
- 1 1/4 x 1/4
- 1 1/2 x 1/8
- 1 1/2 x 1/4
- 1 3/4 x 1/8
- 1 3/4 x 1/4
- 2 x 1/8
- 2 x 1/4
- 2 1/2 x 1/4
- 3 x 1/4
- 3 x 1/2
- 3 3/4 x 1/8
- 4 1/4 x 1/8
- 4 1/4 x 3/16

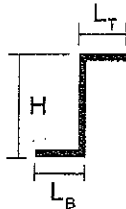
Other sizes available.
Call for details.



FLANGED CHANNEL

W x H x F x t

- 3 x 1 1/2 x 15/16 x 1/8
- 3 3/4 x 1 7/16 x 1 x 1/8
- 5 x 1 1/8 x 1 x 1/8
- 5 x 1 3/8 x 1 x 1/8
- 9 9/16 x 2 3/8 x 1 1/4 x 3/16
- 16 1/2 x 2 3/8 x 1 7/16 x 1/4



ZEEB

L_B x H x L_T x t

- 1 x 1 x 1 3/8 x 1/8
- 1 x 2 x 1 3/8 x 1/8
- 1 x 2 3/8 x 3 1/4 x 1/8



**SOLID SQUARE
ROD**

- 1/8
- 1/4
- 3/8
- 1/2
- 3/4
- 1
- 1 1/4
- 1 1/2
- 2

FLAT SHEET

- 1 1/2 x 1/4
- 2 x 1/4
- 2 x 3/8
- 2 x 1/2
- 3 x 3/16
- 3 x 3/8
- 3 x 1/2
- 3 x 3/4
- 4 x 3/16
- 4 x 1/4
- 4 x 3/8
- 4 x 1/2
- 5 x 1/2
- 6 x 1/4
- 6 x 3/8
- 6 x 1/2
- 7 x 1/4
- 7 x 1/2
- 9 x 1/4
- 12 x 1/2
- 22 x 1/4
- 22 x 3/8
- 24 x 3/16
- 24 x 1/2
- 48 x 1/8
- 48 x 3/16
- 48 x 1/4
- 48 x 3/8
- 48 x 1/2



SOLID ROUND ROD

- | | |
|------|-------|
| 1/8 | 3/4 |
| 3/16 | 13/16 |
| 1/4 | 7/8 |
| 5/16 | 1 |
| 3/8 | 1 1/8 |
| 7/16 | 1 1/4 |
| 1/2 | 1 1/2 |
| 9/16 | 1 3/4 |
| 5/8 | 2 |

Note: This is a partial list of pultruded shapes available. For specific shapes not shown, or for possible modification of existing shapes, please contact Liberty Pultrusions.

Contact Liberty Pultrusions for availability and pricing for Polyglas C, Polyglas M, Polyglas F (and other) Products.

Liberty Pultrusions structurals are available in the following resin systems:

- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
- Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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TECHNICAL DATA

Specification for Liberty Pultrusions Pultruded Structural Shapes (long form)

PART 1 GENERAL

1.01 Description of Work

This specification covers Fiberglass Reinforced Polymer (FRP) pultruded structural shapes and associated connections as indicated on the drawings; including but limited to:

- A. Fiberglass Reinforced Polymer (FRP) pultruded structural shapes.
- B. Fasteners; required for attachment of the FRP structural shapes to the structure and for attachment of FRP panels to the FRP structural shapes.

1.02 Quality Assurance

- A. Products of Liberty Pultrusions establish the minimum required level of quality.
- B. Manufacturer shall have a minimum of 10 years experience in the production of pultruded structural shapes.

1.03 Product Substitutions

- A. Any substitutions must meet the minimum quality and performance standards specified.
- B. Applications for substitution must include technical information, samples and any other information determined required for evaluation.

1.04 Design Criteria

- A. Pultruded structural shapes and connections shall be designed to resist loads in accordance with the governing building code.

Structural pultrusions used as purlins shall be designed to resist roof dead loads of _____ PSF and wind loads of _____ PSF.

Structural pultrusions used as wall girts shall be designed to resist wind loads of _____ PSF.

- B. Design deflection limit for roof purlins shall be: (choose one) L/180, L/240. Design deflection limit for wall girts shall be: (choose one) L/90, L/120, L/180

PART 2 GENERAL

2.01 Materials

- A. Pultruded structural shapes shall be manufactured by Liberty Pultrusions and shall conform to the specifications for the following products: (choose one)
 - Liberty Pultrusions Polyglas F - Fire retardant, Polyester, gray color
 - Liberty Pultrusions Polyglas C - Fire retardant, Vinyl Ester, beige color
 - Liberty Pultrusions Polyglas M - Non-Fire retardant, Polyester, olive color

- B. All pultruded structural shapes shall be manufactured with UV inhibitors and C/W Barrier for corrosion and weathering protection.
- C. All pultruded structural shapes shall achieve a flame spread of 25 or less when tested in accordance with ASTM E-84 (Polyglas F and C only).
- D. Fasteners used for attachment of pultruded structural shapes shall be stainless steel, (choose one) Type 304 or Type 316, of the size shown on the drawings.
- E. Fasteners used for attachment of FRP panels to pultruded structural shapes shall be 1/4 x 14, Type A, stainless steel, (choose one) Type 304 or Type 316.

PART 3 EXECUTION

3.01 Storage Handling

- A. Storage and handling of pultruded structural shapes shall be done in a manner to protect against physical damage and premature contact with moisture and UV radiation. All pultruded structural shapes shall be stored to prevent breakage, cuts, cracks, bends, twists, and dents. It is recommended that the pultruded structural shapes be stored above ground and covered with a water proof, opaque material.

3.02 Inspection

- A. Examine alignment and condition of structural steel prior to installation of pultruded structural shapes and do not proceed until the defects are corrected by the responsible contractor.

3.03 Installation

- A. All factory and field cut edges, holes and abrasions shall be field coated using a sealer compatible with the original resin as recommended by the manufacturer.
- B. Pultruded structural shapes shall be installed true and square with the existing building structure in accordance with the drawings.
- C. Fasteners shall be one of the type and size specified on the drawings.

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Specification for Liberty Pultrusions Pultruded Structural Shapes (short form)

1. Pultruded FRP structural shapes shall be Polyglas Structural as manufactured by Liberty Pultrusions.
2. Pultruded structural shapes shall be: (choose one)
 - Liberty Pultrusions Polyglas F - Fire retardant, Polyester, gray color
 - Liberty Pultrusions Polyglas C - Fire retardant, Vinyl Ester, beige color
 - Liberty Pultrusions Polyglas M - Non-Fire retardant, Polyester, olive color
3. All pultruded structural shapes shall be manufactured with UV inhibitors and C/W Barrier for corrosion and weathering protection.
4. All Pultruded structural shapes shall achieve a flame spread of 25 or less when tested in accordance with ASTM E-84 (Polyglas F and Polyglas C only).
5. Pultruded structural shapes and connections shall be designed to resist loads in accordance with the governing building code.
 - Structural pultrusions used as purlins shall be designed to resist roof dead loads of _____ PSF and wind loads of _____ PSF.
 - Structural pultrusions used as girts shall be designed to resist wall wind loads of _____ PSF.
6. Design deflection limit for roof purlins shall be: (choose one)
 - **L/180**
 - L/240.Design deflection limit for wall girts shall be: (choose one)
 - L/90
 - **L/120**
 - L/180.
7. Fasteners used for connections of pultruded structural shapes shall be stainless steel, (choose one)
 - Type 304 or
 - Type 316.



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Physical Properties

Property	Test Method	Direction	Units	Liberty Pultrusions Polyglas F	Liberty Pultrusions Polyglas C	Liberty Pultrusions Polyglas M
MECHANICAL COUPON						
Ultimate Tensile Strength	ASTM D-638	Longitudinal	PSI	30,000	30,000	30,000
	ASTM D-638	Transverse	PSI	6,500	7,000	6,500
Tensile Modulus	ASTM D-638	Longitudinal	PSI	2.5 x 10 ⁶	2.6 x 10 ⁶	2.5 x 10 ⁶
	ASTM D-638	Transverse	PSI	0.8 x 10 ⁶	0.8 x 10 ⁶	0.8 x 10 ⁶
Ultimate Compressive Strength	ASTM D-695	Longitudinal	PSI	30,000	30,000	30,000
	ASTM D-695	Transverse	PSI	15,000	16,000	15,000
Compressive Modulus	ASTM D-695	Longitudinal	PSI	2.3 x 10 ⁶	2.6 x 10 ⁶	2.3 x 10 ⁶
	ASTM D-695	Transverse	PSI	0.8 x 10 ⁶	1.0 x 10 ⁶	0.8 x 10 ⁶
Ultimate Flexural Strength	ASTM D-790	Longitudinal	PSI	30,000	30,000	30,000
	ASTM D-790	Transverse	PSI	10,000	10,000	10,000
Flexural Modulus	ASTM D-790	Longitudinal	PSI	1.6 x 10 ⁶	1.6 x 10 ⁶	1.6 x 10 ⁶
	ASTM D-790	Transverse	PSI	0.8 x 10 ⁶	0.8 x 10 ⁶	0.8 x 10 ⁶
Shear Strength Short Beam	ASTM D-2344	Longitudinal	PSI	4,500	5,500	4,500
	ASTM D-2344	Transverse	PSI	4,500	5,500	4,500
Impact Strength - Izod	ASTM D-256	Longitudinal	Ft - lb/in	25	25	25
	ASTM D-256	Transverse	Ft - lb/in	4	4	4
Hardness - Barcol	ASTM D-2583	Perpendicular		50	45	50

MECHANICAL - FULL SECTION BENDING

Modulus of Elasticity	Longitudinal	PSI	2.5 x 10 ⁶	2.8 x 10 ⁶	2.5 x 10 ⁶
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ELECTRICAL

Electric Strength Short Time (In Oil)	ASTM D-149	Perpendicular	Volts/mil	200	200	200
	ASTM D-149	Parallel	KV/in.	35	35	35

OTHER

Thermal Coefficient of Expansion	ASTM D-149	Longitudinal	in/in/°C	5 x 10 ⁻⁶	5 x 10 ⁻⁶	5 x 10 ⁻⁶
Thermal Conductivity		Longitudinal	BTU/Hr/sq ft/in/°F	4.0	4.0	4.0
Flame Class	UL 94			V-0		
Flame spread (UL Tunnel Test)	ASTM E-84			25 or less	25 or less	
Water Absorption 24 Hours	ASTM D-570	Longitudinal	%	0.6 Max	0.6 Max	0.6 Max
Density	ASTM D-792	Longitudinal	lbs/in. ³	0.0656	0.0656	0.0656
Color (Standard)				Gray	Beige	Olive

The above data is based on results achieved in test methods indicated and is provided for information purposes only.

Ordering Information: Standard Lengths: 10 or 20 ft +1/2", -0 in. Special lengths quoted on request.

Liberty Pultrusions structurals are available in the following resin systems:

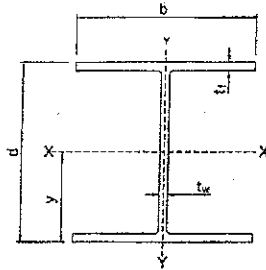
Polyglas F: Fire Retardant, Polyester, Gray Color
Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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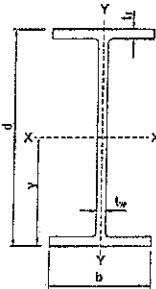


Section Properties

WIDE FLANGE BEAMS

PHYSICAL PROPERTIES						SECTION PROPERTIES						DESIGN PROPERTIES		
SIZE				A	NOM. Wt/Ft	AXIS X - X			AXIS Y - Y			$\frac{b_f}{t_f}$	A _w	J
d	b _f	t _w	t _f			I	S	r	I*	S	r			
in	in	in	in	in ²	lbs	in ⁴	in ³	in	in ⁴	in ³	in	in ²	in ⁴	
3	3	1/4	1/4	2.13	1.68	3.17	2.11	1.22	1.13	0.75	0.73	12.00	0.63	0.044
4	4	1/4	1/4	2.89	2.28	7.94	3.97	1.66	2.67	1.34	0.97	16.00	0.88	0.060
6	6	1/4	1/4	4.39	3.46	28.28	9.43	2.54	9.00	3.00	1.44	24.00	1.38	0.091
*6	6	3/8	3/8	6.48	5.10	40.17	13.40	2.50	13.52	4.50	1.45	16.00	1.97	0.303
*8	8	3/8	3/8	8.73	6.87	99.18	24.80	3.38	32.03	8.01	1.92	21.33	2.72	0.409

Selected Structural Shapes. Other shapes Available.



I BEAMS

PHYSICAL PROPERTIES					SECTION PROPERTIES						DESIGN PROPERTIES			
SIZE				A	NOM. Wt/Ft	AXIS X - X			AXIS Y - Y			$\frac{b_f}{t_f}$	A _w	J
d	b _f	t _w	t _f			I	S	r	I*	S	r			
in	in	in	in	in ²	lbs	in ⁴	in ³	in	in ⁴	in ³	in	in ²	in ⁴	
3	1 1/2	1/4	1/4	1.38	1.09	1.75	1.17	1.13	0.14	0.19	0.32	6.00	0.63	0.029
4	2	1/4	1/4	1.89	1.49	4.40	2.20	1.54	0.34	0.34	0.43	8.00	0.88	0.039
6	3	1/4	1/4	2.88	2.27	15.92	5.32	2.36	1.13	0.76	0.63	12.00	1.38	0.060
6	3	3/8	3/8	4.23	3.33	22.30	7.43	2.31	1.71	1.14	0.64	8.00	1.97	0.198
8	4	3/8	3/8	5.73	4.51	55.45	13.85	3.12	4.03	2.02	0.84	10.67	2.72	0.268

Selected Structural Shapes. Other shapes Available.

Liberty Pultrusions structurals are available in the following resin systems:

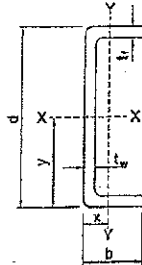
- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
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Section Properties

CHANNELS

PHYSICAL PROPERTIES						SECTION PROPERTIES							DESIGN PROPERTIES		
SIZE				A	NOM. Wt/Ft	AXIS X - X			AXIS Y - Y				b _t / t _f	A _w	J
d	b _f	t _w	t _f			I	S	r	I	S _{MIN}	r	x			
in	in	in	in	in ²	lbs	in ⁴	in ³	in	in ⁴	in ³	in	in	in ²	in ⁴	
2	13/16	1/8	1/8	0.41	0.32	0.22	0.22	0.74	0.02	0.04	0.24	0.23	6.50	0.25	0.002
2	1	3/16	3/16	0.66	0.52	0.36	0.36	0.74	0.06	0.09	0.30	0.33	5.33	0.38	0.008
2	1	1/4	1/4	0.88	0.69	0.41	0.41	0.71	0.07	0.11	0.29	0.36	4.00	0.38	0.017
2 3/4	1	1/8	1/8	0.55	0.43	0.58	0.42	1.02	0.05	0.06	0.29	0.26	8.00	0.34	0.003
3	3/4	1/8	1/8	0.52	0.41	0.58	0.39	1.06	0.02	0.04	0.20	0.18	6.00	0.38	0.003
3	7/8	1/4	1/4	1.03	0.81	1.08	0.72	1.03	0.05	0.09	0.23	0.26	3.50	0.75	0.021
3	1	3/16	3/16	0.87	0.68	1.03	0.68	1.09	0.07	0.09	0.28	0.27	5.33	0.49	0.010
3	1 1/2	1/4	1/4	1.34	1.05	1.68	1.12	1.12	0.27	0.26	0.45	0.48	6.00	0.75	0.028
3	1 7/8	3/16	3/16	1.18	0.93	1.63	1.09	1.18	0.41	0.32	0.59	0.60	10.00	0.56	0.014
3 1/4	1 5/8	1/8	1/8	0.77	0.61	1.25	0.77	1.27	0.20	0.17	0.51	0.46	13.00	0.41	0.004
3 1/2	1 3/16	1/8	3/16	0.83	0.65	1.61	0.89	1.39	0.11	0.13	0.37	0.35	6.33	0.39	0.007
4	1 1/16	1/8	1/8	0.71	0.56	1.55	0.78	1.45	0.01	0.08	0.29	0.23	8.50	0.47	0.004
*4	1 1/8	1/4	1/4	1.38	1.09	2.87	1.43	1.41	0.13	0.15	0.30	0.30	4.50	0.88	0.030
4	1 3/8	3/16	3/16	1.16	0.91	2.62	1.31	1.48	0.19	0.18	0.40	0.35	7.33	0.68	0.014
4	3	1/2	1/2	4.00	3.15	9.95	4.97	1.51	3.73	1.97	0.92	1.11	6.00	1.00	0.365
4 1/8	1 13/16	3/8	1/4	2.26	1.78	4.90	2.37	1.47	0.54	0.41	0.49	0.48	7.25	1.55	0.085
4 3/4	1 5/8	3/16	3/16	1.41	1.11	4.37	1.84	1.76	0.31	0.26	0.47	0.40	8.67	0.89	0.016
5	1 3/8	1/4	1/4	1.76	1.39	5.78	2.31	1.79	0.25	0.24	0.37	0.34	5.50	1.12	0.120
*6	1 5/8	1/4	1/4	2.13	1.68	10.22	3.41	2.16	0.43	0.35	0.44	0.38	6.50	1.38	0.050
6	2	1/4	1/4	2.38	1.87	11.45	3.82	2.21	0.78	0.52	0.58	0.50	8.00	1.38	0.049
7 3/4	1 3/4	1/4	1/4	2.69	2.12	19.76	5.10	2.73	0.56	0.41	0.46	0.37	7.00	1.81	0.055
*8	2 3/16	3/8	3/8	4.36	3.43	33.75	8.94	2.87	1.42	0.86	0.57	0.53	5.83	2.72	0.200
8 1/2	2 11/16	3/16	3/16	2.53	1.99	25.46	5.99	3.18	1.56	0.74	0.79	0.60	14.33	1.52	0.029
*10	2 3/4	1/2	1/2	7.06	5.56	88.01	17.60	3.53	8.93	1.91	0.75	0.69	5.50	4.50	0.588
11 1/4	1 5/8	3/8	3/8	4.99	3.93	67.12	11.90	3.67	0.67	0.52	0.37	0.34	4.33	3.94	0.234
20	2	1/4	1/4	5.88	4.63	248.71	24.87	6.52	0.99	0.58	0.41	0.28	8.00	4.88	0.122

Selected Structural Shapes. Other shapes Available.

Liberty Pultrusions structurals are available in the following resin systems:

- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
- Polyglas M: Non-Fire Retardant, Polyester, Olive Color

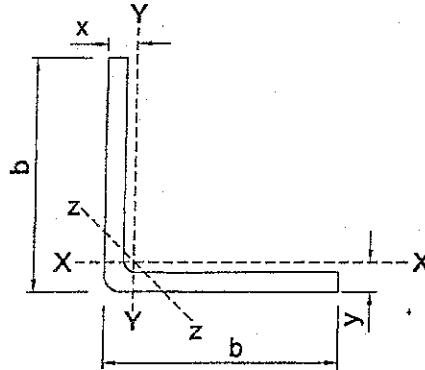


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Section Properties



EQUAL LEG ANGLES

PHYSICAL PROPERTIES				SECTION PROPERTIES						DESIGN PROPERTIES	
SIZE		A	NOM. Wt/Ft	AXIS X - X or Y - Y				AXIS Y - Y		b/t	J
b	t			I	S	r	x or y	I	r		
in	in	in ²	lbs	in ⁴	in ³	in	in	in ³	in	in ⁴	
1	1/8	0.22	0.17	0.02	0.03	0.30	0.29	0.01	0.19	8.00	0.001
1 1/4	1/8	0.29	0.23	0.04	0.05	0.37	0.35	0.02	0.24	10.00	0.002
1 1/4	3/16	0.42	0.33	0.06	0.07	0.37	0.37	0.03	0.24	6.67	0.005
1 1/2	1/8	0.35	0.28	0.07	0.07	0.45	0.41	0.03	0.29	12.00	0.002
1 1/2	3/16	0.51	0.40	0.11	0.10	0.45	0.44	0.04	0.29	8.00	0.006
1 1/2	1/4	0.67	0.53	0.13	0.13	0.44	0.46	0.06	0.29	6.00	0.007
2	3/16	0.70	0.55	0.27	0.19	0.61	0.56	0.11	0.39	10.67	0.008
*2	1/4	0.92	0.72	0.34	0.24	0.60	0.58	0.14	0.39	8.00	0.020
*3	1/4	1.42	1.12	1.18	0.54	0.91	0.82	0.49	0.58	12.00	0.030
3	3/8	2.09	1.65	1.70	0.80	0.90	0.87	0.70	0.58	8.00	0.090
*4	1/4	1.92	1.51	2.94	1.00	1.23	1.07	1.21	0.79	16.00	0.040
*4	3/8	2.84	2.24	4.26	1.48	1.22	1.12	1.75	0.78	10.67	0.134
6	3/8	4.34	3.42	14.85	3.38	1.85	1.60	6.07	1.18	16.00	0.204
6	1/2	5.72	4.50	19.38	4.46	1.84	1.66	7.92	1.17	12.00	0.480

Selected Structural Shapes. Other shapes Available.

Liberty Pultrusions structurals are available in the following resin systems:

- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
- Polyglas M: Non-Fire Retardant, Polyester, Olive Color

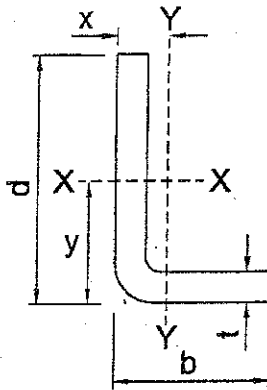


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Section Properties



UNEQUAL LEG ANGLES

PHYSICAL PROPERTIES					SECTION PROPERTIES								DESIGN PROPERTIES
d	b	t	A	NOM. Wt/Ft	AXIS X - X				AXIS Y - Y				J
					I	S _{MIN}	r	y	I	S _{MIN}	r	x	
in	in	in	in ²	lbs	in ⁴	in ³	in	in	in ⁴	in ³	in	in	in ⁴
2	1	1/4	0.662	0.52	0.259	0.214	0.626	0.788	0.044	0.061	0.259	0.269	0.014
2	1 7/8	1/2	1.600	1.26	0.546	0.429	0.584	0.726	0.463	0.381	0.538	0.660	0.133
2 1/4	1 1/2	3/16	0.655	0.52	0.338	0.226	0.718	0.758	0.123	0.109	0.432	0.376	0.008
2 9/16	1 11/16	3/16	0.742	0.58	0.501	0.295	0.822	0.864	0.178	0.140	0.490	0.415	0.009
2 3/4	2	1/4	1.095	0.86	0.832	0.452	0.872	0.912	0.376	0.255	0.586	0.526	0.023
3	2	3/8	1.680	1.32	1.480	0.767	0.939	1.070	0.531	0.367	0.562	0.554	0.079
4	2 1/2	1/4	1.542	1.21	2.569	0.966	1.291	1.341	0.800	0.417	0.720	0.582	0.032
6	1 3/4	3/8	2.570	2.02	8.942	2.671	1.865	2.652	0.207	0.191	0.284	0.290	0.120
6	2	1/4	1.907	1.50	7.141	1.976	1.935	2.387	0.456	0.277	0.489	0.356	0.040
6	3	1/4	2.157	1.70	8.723	2.135	1.958	2.125	1.423	0.623	0.832	0.604	0.045
6	3	3/8	3.179	2.50	11.941	3.126	1.938	2.180	2.115	0.901	0.816	0.654	0.149
6	4 1/2	1/2	4.913	3.87	17.836	4.384	1.905	1.931	8.710	2.614	1.332	1.168	0.409

Selected Structural Shapes. Other shapes Available.

Liberty Pultrusions structurals are available in the following resin systems:

- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
- Polyglas M: Non-Fire Retardant, Polyester, Olive Color

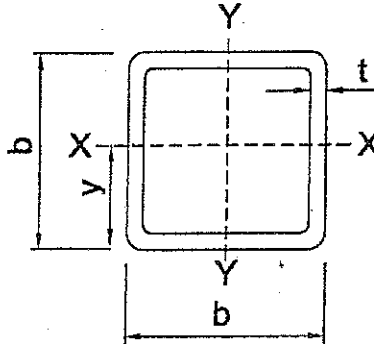


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Section Properties



SQUARE TUBES

PHYSICAL PROPERTIES				SECTION PROPERTIES				DESIGN PROPERTIES	
SIZE		A	NOM. Wt/Ft	I	S	r	A _w	b/t	J
b	t								
in	in	in ²	lbs	in ⁴	in ³	in	in ²		in ⁴
1	1/8	0.43	0.34	0.06	0.11	0.36	0.19	8.00	0.096
1 1/2	1/8	0.68	0.54	0.22	0.29	0.56	0.31	12.00	0.370
1 1/2	1/4	1.24	0.98	0.34	0.45	0.52	0.50	6.00	0.573
1 3/4	1/4	1.49	1.17	0.58	0.66	0.62	0.63	7.00	0.978
* 2	1/8	0.93	0.73	0.55	0.55	0.77	0.44	16.00	0.934
* 2	1/4	1.74	1.37	0.91	0.91	0.73	0.75	8.00	1.542
* 3	1/4	2.74	2.16	3.50	2.33	1.13	1.25	12.00	5.913
* 4	1/4	3.74	2.94	8.82	4.41	1.53	1.75	16.00	14.937

Selected Structural Shapes. Other shapes Available.

Liberty Pultrusions structurals are available in the following resin systems:

- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
- Polyglas M: Non-Fire Retardant, Polyester, Olive Color

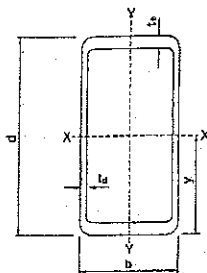


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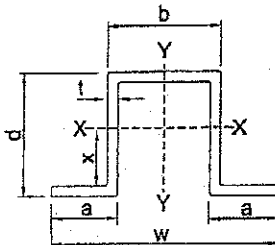
Section Properties



RECTANGULAR TUBES

PHYSICAL PROPERTIES				SECTION PROPERTIES						DESIGN PROPERTIES						
SIZE				A	NOM. Wt/Ft	AXIS X - X			AXIS Y - Y			A _w		b/t _b	d/t _d	J
d	b	t _d	t _b			I	S	r	I	S	r	x-x	y-y			
in	in	in	in	in ²	lbs	in ⁴	in ³	in	in ⁴	in ³	in	in ²	in ²	in ⁴		
4	1	3/16	3/16	1.74	1.37	2.85	1.43	1.28	0.26	0.52	0.39	1.36	0.23	5.33	21.33	0.78
4	2	1/8	1/4	1.88	1.48	4.41	2.21	1.53	1.10	1.10	0.77	0.88	0.88	8.00	32.00	2.64
4 3/4	1 3/4	3/16	3/16	2.30	1.81	6.03	2.54	1.62	1.17	1.34	0.71	1.64	0.52	9.33	25.33	3.11
5	3	3/4	3/4	9.75	7.68	25.89	10.36	1.63	10.27	6.84	1.03	5.25	2.25	4.00	6.67	21.10
5 1/8	2 1/8	3/16	3/16	2.58	2.03	8.21	3.20	1.78	1.98	1.86	0.88	1.78	0.66	11.33	27.33	4.99
6 1/2	2	1/4	1/2	4.75	3.74	24.97	7.68	2.29	2.79	2.79	0.77	2.75	1.50	4.00	26.00	8.02

Selected Structural Shapes. Other shapes Available.



FLANGED CHANNELS

PHYSICAL PROPERTIES							SECTION PROPERTIES							
w	d	b	a	t	A	NOM. Wt/Ft	AXIS X - X				AXIS Y - Y			
in	in	in	in	in	in ²	lbs	I	S _t	S _b	r	y	I	S	r
in	in	in	in	in	in ²	lbs	in ⁴	in ³	in ³	in	in	in ⁴	in ³	in
3	1 1/2	1 3/8	15/16	1/8	0.70	0.55	0.220	0.271	0.320	0.561	0.689	0.408	0.272	0.764
3 3/4	1 7/16	2	1	1/8	0.78	0.61	0.245	0.338	0.335	0.560	0.731	0.822	0.438	1.028
5	1 1/8	3 1/4	1	1/8	0.86	0.68	0.166	0.352	0.254	0.441	0.654	1.864	0.745	1.476
5	1 3/8	3 1/4	1	1/8	0.92	0.72	0.268	0.461	0.337	0.540	0.794	2.016	0.806	1.482
9 9/16	2 3/8	7 7/16	1 1/4	3/16	2.57	2.02	2.034	2.561	1.286	0.889	1.581	23.915	5.002	3.048
16 1/2	2 3/8	14 1/8	1 7/16	1/4	5.12	4.03	3.265	5.407	1.844	0.799	1.771	141.499	17.151	5.257

Selected Structural Shapes. Other shapes Available.

Liberty Pultrusions structurals are available in the following resin systems:

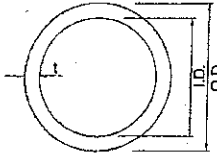
- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
- Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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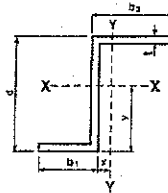


Section Properties

ROUND TUBES

PHYSICAL PROPERTIES					SECTION PROPERTIES			DESIGN PROPERTIES	
SIZE			A	NOM. Wt/Ft	I	S	r	D/t	J
O.D.	I.D.	t							
in	in	in	in ²	lbs	in ⁴	in ³	in		in ⁴
1	3/4	1/8	0.34	0.27	0.03	0.07	0.31	8.00	0.07
1 1/4	1	1/8	0.44	0.35	0.07	0.11	0.40	10.00	0.14
1 1/4	3/4	1/4	0.79	0.62	0.10	0.17	0.36	5.00	0.21
1 1/2	1 1/4	1/8	0.54	0.43	0.13	0.17	0.49	12.00	0.26
1 1/2	1	1/4	0.98	0.77	0.20	0.27	0.45	6.00	0.40
1 3/4	1 1/2	1/8	0.64	0.50	0.21	0.24	0.58	14.00	0.42
1 3/4	1 1/4	1/4	1.18	0.93	0.34	0.39	0.54	7.00	0.68
2	1 3/4	1/8	0.74	0.58	0.32	0.32	0.66	16.00	0.65
2	1 1/2	1/4	1.37	1.08	0.54	0.54	0.63	8.00	1.07
2 1/2	2	1/4	1.77	1.39	1.13	0.91	0.80	10.00	2.26
3	2 1/2	1/4	2.16	1.70	2.06	1.37	0.98	12.00	4.12
3	2	1/2	3.93	3.09	3.19	2.13	0.90	6.00	6.38
3 3/4	3 1/2	1/8	1.42	1.12	2.34	1.25	1.28	30.00	4.68
4 1/4	4	1/8	1.62	1.21	3.45	1.62	1.46	34.00	6.90
4 1/4	3 7/8	3/16	2.39	1.88	4.95	2.33	1.44	22.67	9.89

Selected Structural Shapes.
Other shapes Available.



'Z' SECTIONS

PHYSICAL PROPERTIES						SECTION PROPERTIES						DESIGN PROPERTIES
b ₁	b ₂	d	t	A	NOM. Wt/Ft	AXIS X - X			AXIS Y - Y			J
						I	S _{MIN}	r	I	S _{MIN}	r	
in	in	in	in	in ²	lbs	in ⁴	in ³	in	in ⁴	in ³	in	in ⁴
1	1 3/8	1	1/8	0.382	0.30	0.059	0.106	0.392	0.121	0.103	0.564	0.002
1	1 3/8	2	1/8	0.507	0.40	0.306	0.281	0.776	0.123	0.102	0.493	0.003
1	3 1/4	2 3/8	1/8	0.788	0.62	0.635	0.400	0.897	0.957*	0.390	1.102	0.004

Selected Structural Shapes. Other shapes Available.

Liberty Pultrusions structurals are available in the following resin systems:

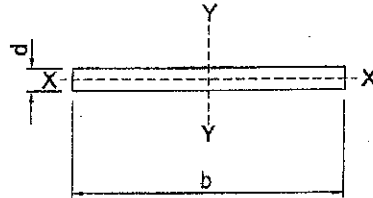
- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
- Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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Section Properties

FLAT SHEET

PHYSICAL PROPERTIES				SECTION PROPERTIES					
SIZE		A	NOM. Wt/Ft	AXIS X - X			AXIS Y - Y		
b	t			I	S	r	I	S	r
in	in	in ²	lbs	in ⁴	in ³	in	in ⁴	in ³	in
1 1/2	1/4	0.375	0.30	0.002	0.016	0.072	0.070	0.094	0.433
2	1/4	0.500	0.39	0.003	0.021	0.072	0.167	0.167	0.577
2	3/8	0.750	0.59	0.009	0.047	0.108	0.250	0.250	0.577
2	1/2	1.000	0.79	0.021	0.083	0.144	0.333	0.333	0.577
3	3/16	0.562	0.44	0.002	0.018	0.054	0.422	0.281	0.866
3	3/8	1.125	0.89	0.013	0.070	0.108	0.844	0.562	0.866
3	1/2	1.500	1.18	0.031	0.125	0.144	1.125	0.750	0.866
3	3/4	2.250	1.77	0.105	0.281	0.216	1.688	1.125	0.866
4	3/16	0.750	0.59	0.002	0.023	0.054	1.000	0.500	1.155
4	1/4	1.000	0.79	0.005	0.042	0.072	1.333	0.667	1.155
4	3/8	1.500	1.18	0.018	0.094	0.108	2.000	1.000	1.155
4	1/2	2.000	1.57	0.042	0.167	0.144	2.667	1.333	1.155
5	1/2	2.500	1.97	0.052	0.208	0.144	5.208	2.083	1.443
6	1/4	1.500	1.18	0.008	0.062	0.072	4.500	1.500	1.732
6	3/8	2.250	1.77	0.026	0.141	0.108	6.750	2.250	1.732
6	1/2	3.000	2.36	0.062	0.250	0.144	9.000	3.000	1.732
7	1/4	1.750	1.38	0.009	0.072	0.072	7.146	2.042	2.021
7	1/2	3.500	2.76	0.073	0.292	0.144	14.291	4.083	2.021
9	1/4	2.250	1.77	0.012	0.094	0.072	15.188	3.375	2.598
12	1/2	6.000	4.72	0.125	0.500	0.144	72.000	12.000	3.464
22	1/4	5.500	4.33	0.029	0.229	0.072	221.83	20.167	6.351
22	3/8	8.250	6.49	0.097	0.516	0.108	332.75	30.250	6.351
24	3/16	4.500	3.54	0.013	0.141	0.054	216.00	18.000	6.928
* 24	1/4	6.000	4.72	0.031	0.250	0.072	288.00	24.000	6.928
* 24	3/8	9.000	7.08	0.105	0.562	0.108	432.00	36.000	6.928
24	1/2	12.000	9.45	0.250	0.999	0.144	575.56	47.960	6.928

Selected Structural Shapes. Other shapes Available.

Liberty Pultrusions structurals are available in the following resin systems:

- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
- Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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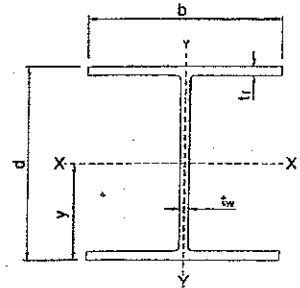
TECHNICAL DATA

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1810 Diamond Street • San Marcos, CA 92069 • Phone 760.744.6371 • Fax 760.744.0201

Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 8 x 8 x 3/8

SPAN (FT)	UNBRACED		FULLY BRACED					
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
7	1166	1166	1166	1166	1166	1166	885	1166
8	1020	1020	1020	1020	884	1020	663	1020
9	907	907	907	907	675	907	506	832
10	724	816	789	816	525	816	394	676
11	503	693	623	693	415	693	311	555
12	362	583	500	583	333	583	250	460
13	268	496	406	496	271	496	203	385
14	203	428	334	428	223	428	167	325
15	157	373	278	373	185	368	139	276
16	124	328	233	328	155	314	116	236
17	99	290	197	290	132	270	99	203
18	81	259	169	259	112	234	84	176
19	66	232	145	232	97	204	72	153
20	55	210	125	210	84	178	63	134
21	47	190	109	190	73	157	55	118



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 8 x 8 x 3/8

SPAN (FT)	UNBRACED		BRACED AT MID SPAN					
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
7	1166	1166	1166	1166	1166	1166	885	1166
8	1020	1020	1020	1020	884	1020	663	1020
9	907	907	907	907	675	907	506	832
10	724	816	789	816	525	816	394	676
11	503	693	623	693	415	693	311	555
12	362	583	500	583	333	583	250	460
13	268	496	406	496	271	496	203	385
14	203	428	334	428	223	428	167	325
15	157	373	278	373	185	368	139	276
16	124	328	233	328	155	314	116	236
17	99	290	197	290	132	270	99	203
18	81	259	169	259	112	234	84	176
19	66	220	145	220	97	204	72	153
20	55	181	125	181	84	178	63	134
21	47	150	109	150	73	150	55	118

BEAM
W8 x 8 x 3/8

Weight = 6.87 LBS/FT
 $I_x = 99.18 \text{ in}^4$
 $S_x = 24.8 \text{ in}^3$
 $A_w = 2.72 \text{ in}^2$
 $J = 0.409 \text{ in}^4$
 $t_f = 3/8 \text{ in}$
 $t_w = 3/8 \text{ in}$

Notes:

- 1) Connection adequacy has not been considered in the span table.
- 2) Beam dead weight has not been included.
- 3) Allowable loads are based on the spacing between lateral bracing as shown above. Contact Liberty Pultrusions for allowable loads for other brace spacings.
- 4) Contact Liberty Pultrusions for pricing and availability.

Liberty Pultrusions structurals are available in the following resin systems:

- Polyglas F: Fire Retardant, Polyester, Gray Color
- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
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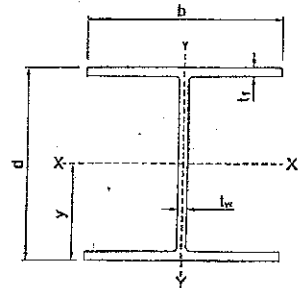
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 6 x 6 x 3/8

SPAN (FT)	UNBRACED		FULLY BRACED					
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
5	1182	1182	1182	1182	1182	1182	943	1182
6	985	985	985	985	851	985	638	985
7	844	844	844	844	596	844	447	747
8	604	739	647	739	431	739	323	570
9	391	657	481	657	320	591	240	443
10	266	591	365	591	243	466	183	350
11	189	537	284	537	189	373	142	280
12	139	485	224	454	149	302	112	227
13	105	413	180	372	120	248	90	186
14	81	356	146	308	97	205	73	154
15	64	310	121	258	80	172	60	129
16	51	273	100	217	67	145	50	109
17	42	241	84	185	56	123	42	92
18	35	215	72	158	48	106	36	79



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 6 x 6 x 3/8

SPAN (FT)	UNBRACED		BRACED AT MID SPAN					
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
5	1182	1182	1182	1182	1182	1182	943	1182
6	985	985	985	985	851	985	638	985
7	844	844	844	844	596	844	447	747
8	604	739	647	739	431	739	323	570
9	391	657	481	657	320	591	240	443
10	266	591	365	591	243	466	183	350
11	189	537	284	537	189	373	142	280
12	139	447	224	447	149	302	112	227
13	105	329	180	329	120	248	90	186
14	81	249	146	249	97	205	73	154
15	64	192	121	192	80	172	60	129
16	51	151	100	151	67	145	50	109
17	42	121	84	121	56	121	42	92
18	35	98	72	98	48	98	36	79

BEAM
W6 x 6 x 3/8
Weight = 5.10 LBS/FT
 $I_x = 40.17 \text{ in}^4$
 $S_x = 13.40 \text{ in}^3$
 $A_w = 1.97 \text{ in}^2$
 $J = 0.303 \text{ in}^4$
 $t_f = 3/8 \text{ in}$
 $t_w = 3/8 \text{ in}$

Notes:

- 1) Connection adequacy has not been considered in the span table.
- 2) Beam dead weight has not been included.
- 3) Allowable loads are based on the spacing between lateral bracing as shown above. Contact Liberty Pultrusions for allowable loads for other brace spacings.
- 4) Contact Liberty Pultrusions for pricing and availability.

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- Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
- Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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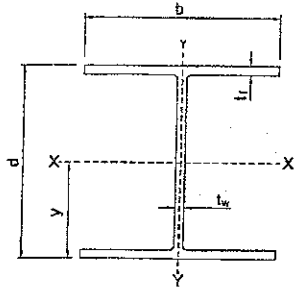
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 6 x 6 x 1/4

SPAN (FT)	UNBRACED	FULLY BRACED							
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection						
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN	
5	828	828	828	828	828	828	662	828	
6	690	690	690	690	598	690	448	690	
7	546	546	546	546	419	546	314	524	
8	369	418	418	418	303	418	227	401	
9	235	330	330	330	225	330	169	311	
10	158	267	257	267	171	267	128	246	
11	110	221	199	221	133	221	100	197	
12	80	186	158	186	105	186	79	159	
13	59	158	126	158	84	158	63	131	
14	45	136	103	136	69	136	51	108	
15	35	119	85	119	57	119	42	90	
16	28	104	71	104	47	102	35	76	



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 6 x 6 x 1/4

SPAN (FT)	UNBRACED	BRACED AT MID SPAN							
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection						
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN	
5	828	828	828	828	828	828	662	828	
6	690	690	690	690	598	690	448	690	
7	546	546	546	546	419	546	314	524	
8	369	418	418	418	303	418	227	401	
9	235	330	330	330	225	330	169	311	
10	158	267	257	267	171	267	128	246	
11	110	221	199	221	133	221	100	197	
12	80	186	158	186	105	186	79	159	
13	59	158	126	158	84	158	63	131	
14	45	136	103	136	69	136	51	108	
15	35	118	85	118	57	118	42	90	
16	28	92	71	92	47	92	35	76	

BEAM
W6 x 6 x 1/4

Weight = 3.46 ^{LBS}/_{FT}
 $I_x = 28.28 \text{ in}^4$
 $S_x = 9.43 \text{ in}^3$
 $A_w = 1.38 \text{ in}^2$
 $J = 0.091 \text{ in}^4$
 $t_f = 1/4 \text{ in}$
 $t_w = 1/4 \text{ in}$

Notes:

- 1) Connection adequacy has not been considered in the span table.
- 2) Beam dead weight has not been included.
- 3) Allowable loads are based on the spacing between lateral bracing as shown above. Contact Liberty Pultrusions for allowable loads for other brace spacings.
- 4) Contact Liberty Pultrusions for pricing and availability.

Liberty Pultrusions structurals are
available in the following resin systems:

Polyglas F: Fire Retardant, Polyester, Gray Color
 Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
 Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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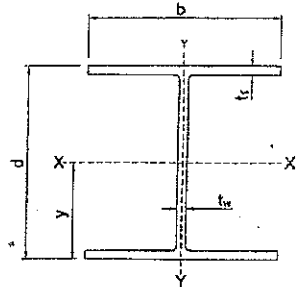
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 4 x 4 x 1/4

SPAN (FT)	UNBRACED	FULLY BRACED						
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
3	880	880	880	880	880	880	778	880
4	660	660	660	660	568	660	426	660
5	512	528	507	528	337	528	253	435
6	261	440	321	440	214	395	160	296
7	149	377	214	377	143	278	107	209
8	93	323	150	303	100	202	75	151
9	61	255	108	226	72	150	54	113
10	43	207	80	172	54	115	40	86
11	31	171	61	134	41	89	31	67
12	23	144	48	106	32	70	24	53
13	18	122	38	85	25	57	19	42



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 4 x 4 x 1/4

SPAN (FT)	UNBRACED	BRACED AT MID SPAN						
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
3	880	880	880	880	880	880	778	880
4	660	660	660	660	568	660	426	660
5	512	528	507	528	337	528	253	435
6	261	440	321	440	214	395	160	296
7	149	377	214	377	143	278	107	209
8	93	298	150	298	100	202	75	151
9	61	190	108	190	72	150	54	113
10	43	128	80	128	54	115	40	86
11	31	90	61	90	41	89	31	67
12	23	65	48	65	32	65	24	53
13	18	49	38	49	25	49	19	42

BEAM
W4 x 4 x 1/4

Weight = 2.28 LBS/FT
 $I_w = 7.94 \text{ in}^4$
 $S_w = 3.97 \text{ in}^3$
 $A_w = 0.88 \text{ in}^2$
 $J = 0.060 \text{ in}^4$
 $t_f = 1/4 \text{ in}$
 $t_w = 1/4 \text{ in}$

Notes:

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- 2) Beam dead weight has not been included.
- 3) Allowable loads are based on the spacing between lateral bracing as shown above. Contact Liberty Pultrusions for allowable loads for other brace spacings.
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 Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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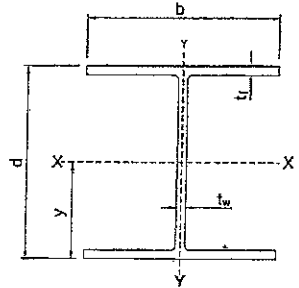
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 3 x 3 x 1/4

SPAN (FT)	UNBRACED	FULLY BRACED							
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection						
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN	
2	945	945	945	945	945	945	945	925	945
3	630	630	630	630	540	630	405	630	630
4	444	473	410	473	273	473	205	362	362
5	202	378	231	378	154	296	116	222	222
6	108	315	142	287	94	191	71	144	144
7	64	270	92	195	62	130	46	97	97
8	41	236	63	137	42	92	32	69	69
9	28	208	45	100	30	67	23	50	50
10	20	169	33	75	22	50	17	37	37
11	15	140	25	58	17	38	13	29	29
12	11	117	20	45	13	30	10	22	22



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR BEAM - W 3 x 3 x 1/4

SPAN (FT)	UNBRACED	BRACED AT MID SPAN							
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection						
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN	
2	945	945	945	945	945	945	945	925	945
3	630	630	630	630	540	630	405	630	630
4	444	473	410	473	273	473	205	362	362
5	202	378	231	378	154	296	116	222	222
6	108	315	142	287	94	191	71	144	144
7	64	180	92	180	62	130	46	97	97
8	41	111	63	111	42	92	32	69	69
9	28	73	45	73	30	67	23	50	50
10	20	50	33	50	22	50	17	37	37
11	15	36	25	36	17	36	13	29	29
12	11	27	20	27	13	27	10	22	22

BEAM
W3 x 3 x 1/4

Weight = 1.68 LBS/FT
 $I_x = 3.17 \text{ in}^4$
 $S_x = 2.11 \text{ in}^3$
 $A_w = 0.63 \text{ in}^2$
 $J = 0.044 \text{ in}^4$
 $t_f = 1/4 \text{ in}$
 $t_w = 1/4 \text{ in}$

Notes:

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 Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
 Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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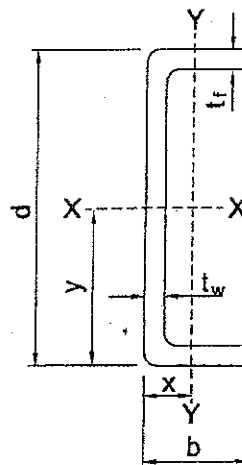
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C11 1/4 x 1 5/8 x 3/8

SPAN (FT)	UNBRACED		FULLY BRACED					
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
7	533	1489	1489	1489	1051	1489	788	1366
8	357	1140	1130	1140	752	1140	564	1031
9	251	901	833	901	555	901	416	793
10	183	730	630	730	419	730	314	620
11	137	603	486	603	324	603	243	492
12	106	507	383	507	255	507	191	396
13	83	432	306	432	204	431	153	323
14	67	372	249	372	166	355	124	266
15	54	324	204	324	136	296	102	222
16	45	285	170	285	113	249	85	187
17	37	252	143	252	95	211	71	158
18	31	225	121	225	81	181	61	135
19	27	202	104	202	69	155	52	117
20	23	182	89	182	59	135	45	101
21	20	158	77	158	52	117	39	88
22	17	137	68	137	45	103	34	77



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C11 1/4 x 1 5/8 x 3/8

SPAN (FT)	UNBRACED		BRACED AT MID SPAN					
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
7	533	1067	1067	1067	1051	1067	788	1067
8	357	715	715	715	715	715	564	715
9	251	502	502	502	502	502	416	502
10	183	366	366	366	366	366	314	366
11	137	275	275	275	275	275	243	275
12	106	212	212	212	212	212	191	212
13	83	167	167	167	167	167	153	167
14	67	133	133	133	133	133	124	133
15	54	108	108	108	108	108	102	108
16	45	89	89	89	89	89	85	89
17	37	74	74	74	74	74	71	74
18	31	63	63	63	63	63	61	63
19	27	53	53	53	53	53	52	53
20	23	46	46	46	46	46	45	46
21	20	40	40	40	40	40	39	40
22	17	34	34	34	34	34	34	34

CHANNEL C11 1/4 x 1 5/8 x 3/8

Weight = 3.93 LBS/FT
 $I_x = 67.12 \text{ in}^4$
 $S_x = 11.90 \text{ in}^3$
 $A_w = 3.94 \text{ in}^2$
 $J = 0.23 \text{ in}^4$
 $t_f = 3/8 \text{ in}$
 $t_w = 3/8 \text{ in}$

Notes:

- 1) Connection adequacy has not been considered in the span table.
- 2) Beam dead weight has not been included.
- 3) Allowable loads are based on the spacing between lateral bracing as shown above. Contact Liberty Pultrusions for allowable loads for other brace spacings.
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Polyglas F: Fire Retardant, Polyester, Gray Color
 Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
 Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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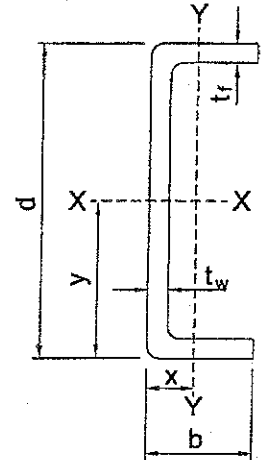
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C10 x 2 3/4 x 1/2

SPAN (FT)	UNBRACED		FULLY BRACED					
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
7	1596	1755	1755	1755	1323	1755	992	1671
8	1069	1344	1344	1344	954	1344	715	1273
9	751	1062	1062	1062	707	1062	530	987
10	547	860	806	860	537	860	403	777
11	411	711	625	711	416	711	312	620
12	317	597	493	597	329	597	246	502
13	249	509	395	509	263	509	198	411
14	199	439	322	439	214	439	161	340
15	162	382	265	382	176	379	132	284
16	134	336	221	336	147	319	110	239
17	111	298	186	298	124	271	93	203
18	94	265	157	265	105	232	79	174
19	80	238	135	238	90	200	67	150
20	68	215	116	215	77	174	58	130
21	59	195	101	195	67	152	50	114
22	51	178	88	178	59	133	44	100
23	45	163	77	163	52	118	39	88



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C10 x 2 3/4 x 1/2

SPAN (FT)	UNBRACED		BRACED AT MIDSPAN					
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
7	1596	1755	1755	1755	1323	1755	992	1671
8	1069	1344	1344	1344	954	1344	715	1273
9	751	1062	1062	1062	707	1062	530	987
10	547	860	806	860	537	860	403	777
11	411	711	625	711	416	711	312	620
12	317	597	493	597	329	597	246	502
13	249	498	395	498	263	498	198	411
14	199	399	322	399	214	399	161	340
15	162	324	265	324	176	324	132	284
16	134	267	221	267	147	267	110	239
17	111	223	186	223	124	223	93	203
18	94	188	157	188	105	188	79	174
19	80	160	135	160	90	160	67	150
20	68	137	116	137	77	137	58	130
21	59	118	101	118	67	118	50	114
22	51	103	88	103	59	103	44	100
23	45	90	77	90	52	90	39	88

**CHANNEL
C10 x 2 3/4 x 1/2**

Weight = 5.56 LBS/FT
 $I_x = 87.94 \text{ in}^4$
 $S_x = 17.59 \text{ in}^3$
 $A_w = 4.5 \text{ in}^2$
 $J = 0.588 \text{ in}^4$
 $t_f = 1/2 \text{ in}$
 $t_w = 1/2 \text{ in}$

Notes:

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- 2) Beam dead weight has not been included.
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 Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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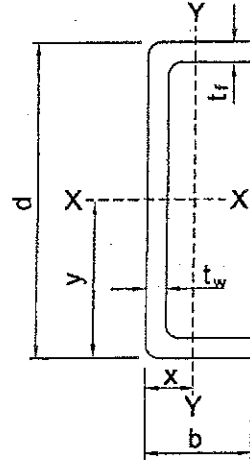
TECHNICAL DATA

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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C8 x 2 3/16 x 3/8

SPAN (FT)	UNBRACED	FULLY BRACED						
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
5	1570	1632	1632	1632	1345	1632	1008	1603
6	908	1148	1148	1148	876	1148	657	1128
7	572	843	843	843	597	843	448	817
8	383	646	634	646	423	646	317	606
9	269	510	463	510	309	510	231	460
10	196	413	348	413	232	413	174	355
11	147	342	267	342	178	342	133	280
12	114	287	209	287	139	287	105	223
13	89	245	167	245	111	241	83	181
14	72	211	135	211	90	198	67	148
15	58	184	111	184	74	164	55	123
16	48	161	92	161	61	137	46	103
17	40	143	77	143	51	116	39	87
18	34	128	65	128	44	99	33	74
19	29	114	56	114	37	85	28	64
20	25	103	48	103	32	73	24	55



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C8 x 2 3/16 x 3/8

SPAN (FT)	UNBRACED	BRACED AT MID SPAN						
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
5	1570	1632	1632	1632	1345	1632	1008	1603
6	908	1148	1148	1148	876	1148	657	1128
7	572	843	843	843	597	843	448	817
8	383	646	634	646	423	646	317	606
9	269	510	463	510	309	510	231	460
10	196	392	348	392	232	392	174	355
11	147	295	267	295	178	295	133	280
12	114	227	209	227	139	227	105	223
13	89	179	167	179	111	179	83	179
14	72	143	135	143	90	143	67	143
15	58	116	111	116	74	116	55	116
16	48	96	92	96	61	96	46	96
17	40	80	77	80	51	80	39	80
18	34	67	65	67	44	67	33	67
19	29	57	56	57	37	57	28	57
20	25	49	48	49	32	49	24	49

**CHANNEL
C8 x 2 3/16 x 3/8**

Weight = 3.43 ^{LBS}/_{FT}
 $I_x = 35.75 \text{ in}^4$
 $S_x = 8.94 \text{ in}^3$
 $A_w = 2.72 \text{ in}^2$
 $J = 0.20 \text{ in}^4$
 $t_f = 3/8 \text{ in}$
 $t_w = 3/8 \text{ in}$

Notes:

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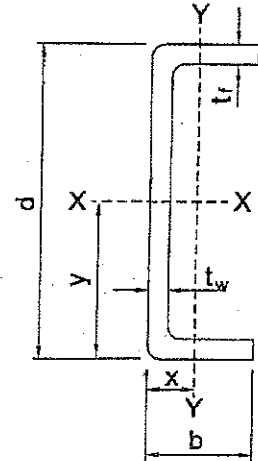
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C6 x 1 5/8 x 1/4

SPAN (FT)	UNBRACED	FULLY BRACED						
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
4	697	889	889	889	785	889	589	889
5	357	569	569	569	458	569	343	569
6	206	395	395	395	286	395	215	395
7	130	290	285	290	190	290	142	285
8	87	222	197	222	131	222	98	205
9	61	176	142	176	95	176	71	151
10	45	142	105	142	70	142	53	114
11	33	118	80	118	53	118	40	89
12	26	99	62	99	42	93	31	70
13	20	84	49	84	33	74	25	56
14	16	73	40	73	27	61	20	45



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C6 x 1 5/8 x 1/4

SPAN (FT)	UNBRACED	BRACED AT MID SPAN						
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection					
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
4	697	889	889	889	785	889	589	889
5	357	569	569	569	458	569	343	569
6	206	395	395	395	286	395	215	395
7	130	260	260	260	190	260	142	260
8	87	174	174	174	131	174	98	174
9	61	122	122	122	95	122	71	122
10	45	89	89	89	70	89	53	89
11	33	67	67	67	53	67	40	67
12	26	52	52	52	42	52	31	52
13	20	41	41	41	33	41	25	41
14	16	32	32	32	27	32	20	32

CHANNEL
C6 x 1 5/8 x 1/4

Weight = 1.68 LBS/FT
 $I_x = 10.22 \text{ in}^4$
 $S_x = 3.41 \text{ in}^3$
 $A_w = 1.38 \text{ in}^2$
 $J = 0.05 \text{ in}^4$
 $t_l = 1/4 \text{ in}$
 $t_w = 1/4 \text{ in}$

Notes:

- 1) Connection adequacy has not been considered in the span table.
- 2) Beam dead weight has not been included.
- 3) Allowable loads are based on the spacing between lateral bracing as shown above. Contact Liberty Pultrusions for allowable loads for other brace spacings.
- 4) Contact Liberty Pultrusions for pricing and availability.

**Liberty Pultrusions structurals are
available in the following resin systems:**

Polyglas F: Fire Retardant, Polyester, Gray Color
 Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
 Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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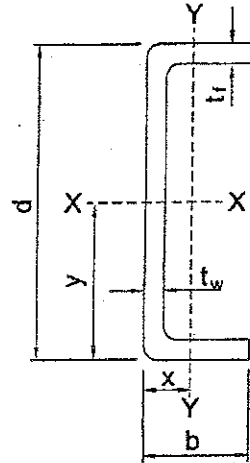
TECHNICAL DATA

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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C4 x 1 1/8 x 1/4

SPAN (FT)	UNBRACED	FULLY BRACED							
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection						
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN	
2	1320	1320	1320	1320	1320	1320	1053	1320	
3	880	880	847	880	564	880	423	727	
4	430	529	408	529	272	521	204	390	
5	220	338	224	338	149	305	112	229	
6	127	235	135	235	90	192	67	144	
7	80	173	87	173	58	127	43	95	
8	54	132	59	132	39	88	30	66	
9	38	104	42	95	28	64	21	48	
10	28	85	31	71	21	47	15	35	



MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR CHANNEL - C4 x 1 1/8 x 1/4

SPAN (FT)	UNBRACED	BRACED AT MID SPAN							
	Limited By Stress (Fb or Fv)	Limited By Stress (Fb or Fv)	Limited By Deflection						
			L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN	
2	1320	1320	1320	1320	1320	1320	1053	1320	
3	880	880	847	880	564	880	423	727	
4	430	529	408	529	272	521	204	390	
5	220	338	224	338	149	305	112	229	
6	127	235	135	235	90	192	67	144	
7	80	161	87	161	58	127	43	95	
8	54	108	59	108	39	88	30	66	
9	38	76	42	76	28	64	21	48	
10	28	55	31	55	21	47	15	35	

CHANNEL
C4 x 1 1/8 x 1/4

Weight = 1.09 LBS/FT
 $I_x = 2.87 \text{ in}^4$
 $S_x = 1.43 \text{ in}^3$
 $A_w = 0.88 \text{ in}^2$
 $J = 0.03 \text{ in}^4$
 $t_f = 1/4 \text{ in}$
 $t_w = 1/4 \text{ in}$

Notes:

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 Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
 Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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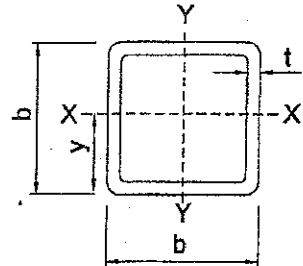
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR TUBE - ST 4 x 4 x 1/4

SPAN (FT)	Limited By Stress (Fb or Fv)	Limited By Deflection					
		L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
3	1380	1380	1380	1380	1380	1043	1380
4	1035	1035	1035	730	1035	547	915
5	724	632	724	421	724	316	577
6	503	393	503	262	503	196	382
7	369	259	369	173	352	129	264
8	283	179	283	119	251	89	188
9	223	129	223	86	185	64	139
10	181	95	181	63	139	48	105
11	150	72	150	48	108	36	81
12	126	56	126	37	85	28	63
13	107	45	101	30	68	22	51
14	92	36	82	24	55	18	41
15	80	29	68	20	45	15	34
16	71	24	56	16	37	12	28
17	63	20	47	14	31	10	24

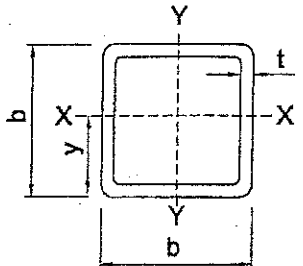


**SQUARE TUBE
ST 4 x 4 x 1/4**

Weight = 2.94 LBS/FT
I = 8.82 in⁴
S = 4.41 in³
A_w = 1.75 in²
J = 14.937 in⁴
t = 1/4 in

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR TUBE - ST 3 x 3 x 1/4

SPAN (FT)	Limited By Stress (Fb or Fv)	Limited By Deflection					
		L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
2	1875	1875	1875	1835	1875	1376	1875
3	1250	1076	1250	717	1250	537	953
4	734	511	734	340	668	255	501
5	470	278	470	185	386	139	289
6	326	166	326	111	240	83	180
7	240	107	238	71	158	53	119
8	184	73	164	48	109	36	82
9	145	52	118	34	79	26	59
10	117	38	87	25	58	19	44
11	97	29	66	19	44	14	33
12	82	22	52	15	34	11	26



**SQUARE TUBE
ST 3 x 3 x 1/4**

Weight = 2.16 LBS/FT
I = 3.50 in⁴
S = 2.33 in³
A_w = 1.25 in²
J = 5.913 in⁴
t = 1/4 in

Notes:

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- 2) Beam dead weight has not been included.
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Polyglas F: Fire Retardant, Polyester, Gray Color
Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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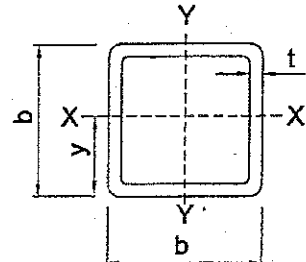
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR TUBE - ST 2 x 2 x 1/4

SPAN (FT)	Limited By Stress (Fb or Fv)	Limited By Deflection					
		L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
1	2250	2250	2250	2250	2250	2170	2250
2	1125	950	1125	633	1125	475	845
3	719	327	666	218	444	163	333
4	405	146	318	97	212	73	159
5	259	77	173	51	115	38	86
6	180	45	104	30	69	23	52
7	132	29	67	19	44	14	33
8	101	19	45	13	30	10	23
9	80	14	32	9	21	7	16
10	65	10	24	7	16	5	12

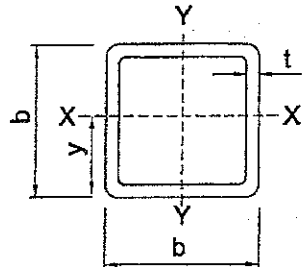


**SQUARE TUBE
ST 2 x 2 x 1/4**

Weight = 1.37 LBS/FT
I = 0.91 in⁴
S = 0.91 in³
A_w = 0.75 in²
J = 1.542 in⁴
t = 1/4 in

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR TUBE - ST 2 x 2 x 1/8

SPAN (FT)	Limited By Stress (Fb or Fv)	Limited By Deflection					
		L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
1	1313	1313	1313	1313	1313	1285	1313
2	543	543	543	379	543	284	503
3	241	197	241	131	241	98	199
4	136	88	136	59	127	44	95
5	87	46	87	31	69	23	52
6	60	27	60	18	42	14	31
7	44	17	40	12	27	9	20
8	34	12	27	8	18	6	14
9	27	8	19	6	13	4	10
10	22	6	14	4	10	3	7



**SQUARE TUBE
ST 2 x 2 x 1/8**

Weight = 0.73 LBS/FT
I = 0.55 in⁴
S = 0.55 in³
A_w = 0.44 in²
J = 0.934 in⁴
t = 1/8 in

Notes:

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Polyglas F: Fire Retardant, Polyester, Gray Color
Polyglas C: Fire Retardant, Vinyl Ester, Beige Color
Polyglas M: Non-Fire Retardant, Polyester, Olive Color



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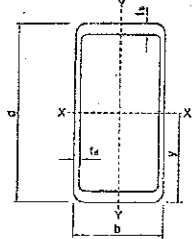
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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR TUBE - RT 6 1/2 x 2 x 1/4 x 1/2

SPAN (FT)	Limited By Stress (Fb or Fv)	Limited By Deflection					
		L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
7	1179	674	1179	449	873	336	654
8	960	470	951	313	634	235	475
9	759	340	709	226	472	170	354
10	614	253	540	168	360	126	270
11	508	193	420	129	280	96	210
12	427	150	332	100	221	75	166
13	364	119	267	80	178	60	133
14	313	96	217	64	145	48	109
15	273	79	179	53	119	39	90
16	240	65	149	44	100	33	75
17	213	55	126	36	84	27	63
18	190	46	107	31	71	23	53
19	170	39	92	26	61	20	46
20	154	34	79	23	53	17	39

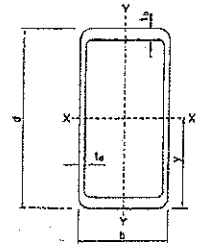


RECTANGULAR TUBE
RT 6 1/2 x 2 x 1/4 x 1/2

Weight = 3.74 LBS/FT
 $I_x = 24.97 \text{ in}^4$
 $S_x = 7.68 \text{ in}^3$
 $A_w = 2.75 \text{ in}^2$
 $J = 8.02 \text{ in}^4$
 $t_b = 1/2 \text{ in}$
 $t_d = 1/4 \text{ in}$

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR TUBE - RT 5 1/8 x 2 1/8 x 3/16 x 3/16

SPAN (FT)	Limited By Stress (Fb or Fv)	Limited By Deflection					
		L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
3	1780	1780	1780	1443	1780	1082	1729
4	1058	1058	1058	723	1058	542	975
5	677	608	677	405	677	304	591
6	470	371	470	247	470	185	380
7	346	242	346	161	342	121	257
8	265	165	265	110	241	83	180
9	209	118	209	79	175	59	131
10	169	87	169	58	131	43	98
11	140	66	140	44	100	33	75
12	118	51	117	34	78	26	59
13	100	40	93	27	62	20	47
14	86	32	76	22	50	16	38
15	75	26	62	18	41	13	31
16	66	22	51	15	34	11	26



RECTANGULAR TUBE
RT 5 1/8 x 2 1/8 x 3/16 x 3/16

Weight = 2.03 LBS/FT
 $I_x = 8.21 \text{ in}^4$
 $S_x = 3.20 \text{ in}^3$
 $A_w = 1.78 \text{ in}^2$
 $J = 4.99 \text{ in}^4$
 $t_b = 3/16 \text{ in}$
 $t_d = 3/16 \text{ in}$

Notes:

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- 2) Beam dead weight has not been included.
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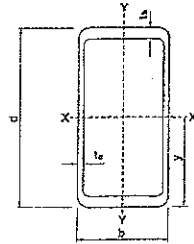
TECHNICAL DATA

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Load/Span Tables

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR TUBE - RT 4 x 2 x 1/8 x 1/4

SPAN (FT)	Limited By Stress (Fb or Fv)	Limited By Deflection					
		L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
3	880	880	880	752	880	564	880
4	660	571	660	380	660	285	505
5	528	322	528	214	412	161	309
6	437	197	400	131	267	98	200
7	321	129	271	86	181	64	136
8	246	88	191	59	127	44	96
9	194	63	139	42	93	32	70
10	157	47	104	31	70	23	52
11	130	35	80	24	53	18	40
12	109	27	63	18	42	14	31
13	93	22	50	14	33	11	25

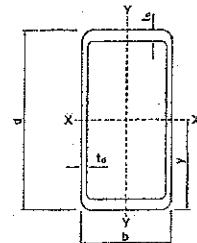


RECTANGULAR TUBE
RT 4 x 2 x 1/8 x 1/4

Weight = 1.48 LBS/FT
 $I_x = 4.41 \text{ in}^4$
 $S_x = 2.21 \text{ in}^3$
 $A_w = 0.88 \text{ in}^2$
 $J = 2.64 \text{ in}^4$
 $t_b = 1/8 \text{ in}$
 $t_d = 1/8 \text{ in}$

MAXIMUM ALLOWABLE LOAD (LBS/FT) FOR TUBE - RT 4 x 1 x 3/16 x 3/16

SPAN (FT)	Limited By Stress (Fb or Fv)	Limited By Deflection					
		L/120 1 SPAN	L/120 2 SPAN	L/180 1 SPAN	L/180 2 SPAN	L/240 1 SPAN	L/240 2 SPAN
3	1271	936	1271	624	1167	468	875
4	715	433	715	289	591	217	443
5	458	232	458	155	333	116	250
6	318	138	307	92	204	69	153
7	233	88	200	59	133	44	100
8	179	60	137	40	92	30	69
9	141	42	98	28	65	21	49
10	114	31	72	21	48	15	36
11	95	23	55	16	37	12	27



RECTANGULAR TUBE
RT 4 x 1 x 3/16 x 3/16

Weight = 1.37 LBS/FT
 $I_x = 2.85 \text{ in}^4$
 $S_x = 1.43 \text{ in}^3$
 $A_w = 1.36 \text{ in}^2$
 $J = 0.78 \text{ in}^4$
 $t_b = 3/16 \text{ in}$
 $t_d = 3/16 \text{ in}$

Notes:

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- 2) Beam dead weight has not been included.
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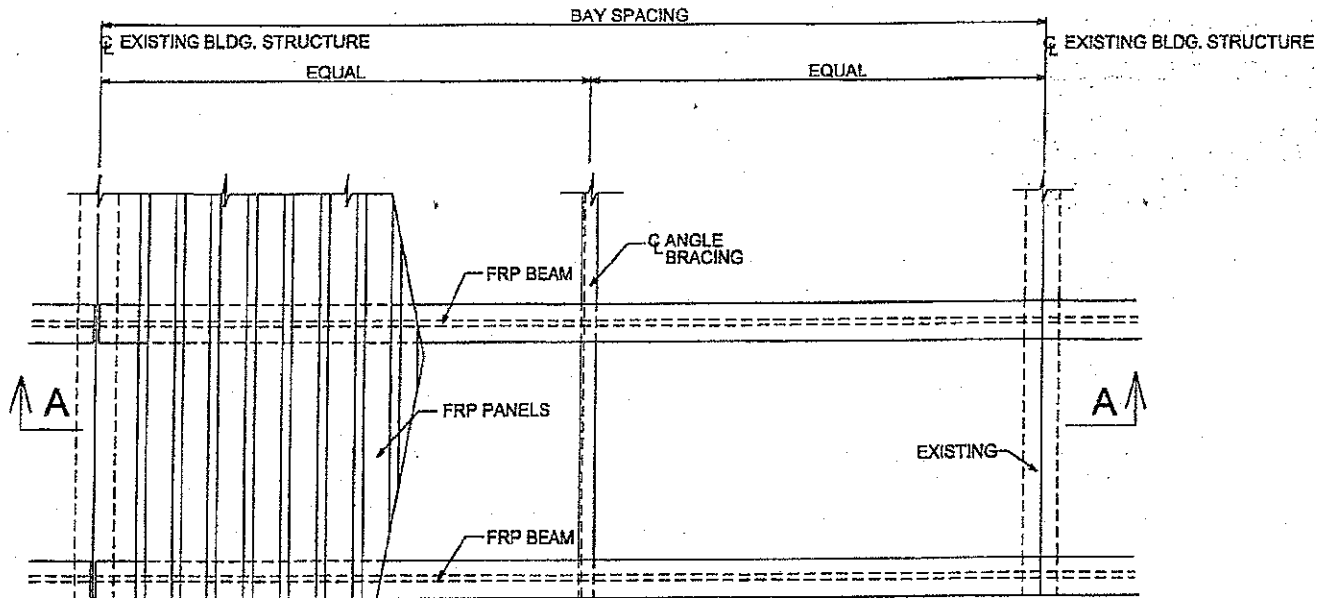


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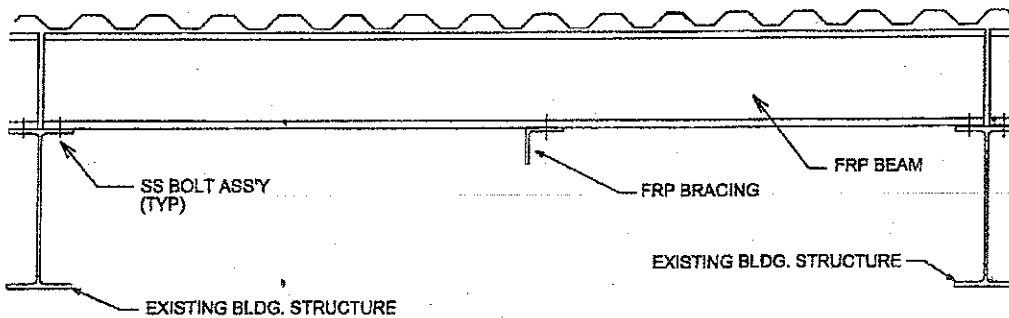
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Product Details



**TYPICAL SUPPORT
& PANEL LAYOUT**



SECTION A-A

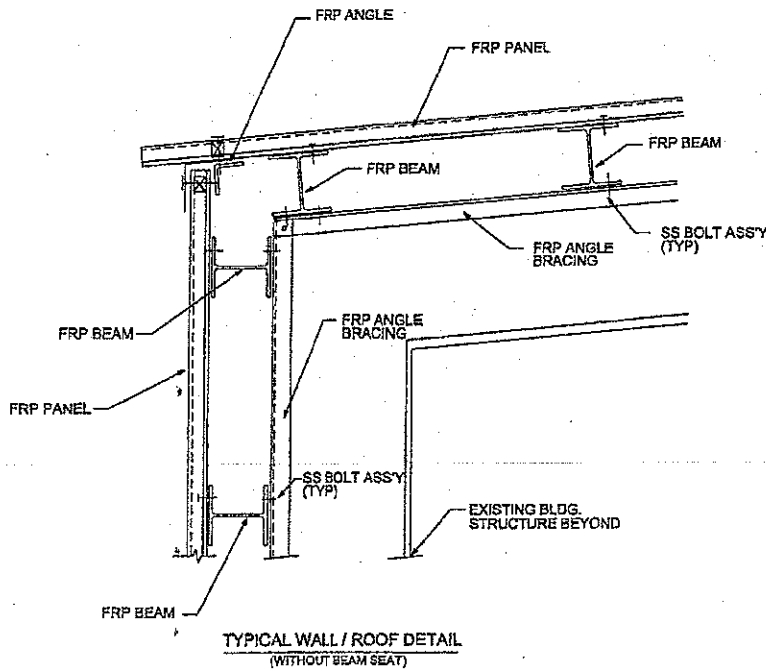
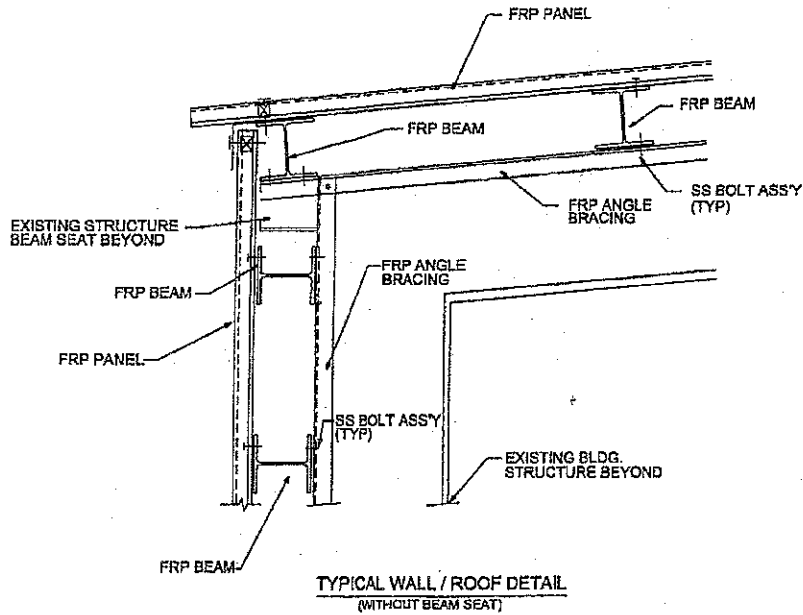


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Product Details





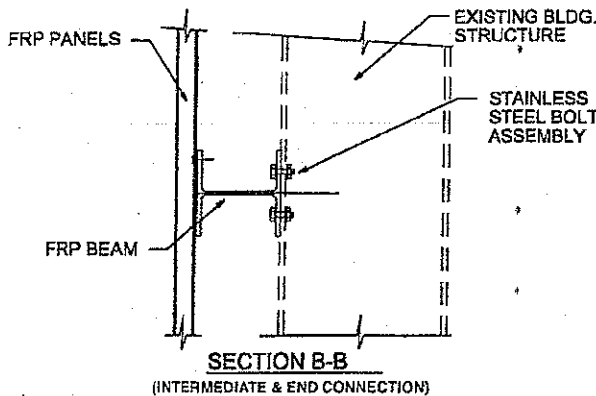
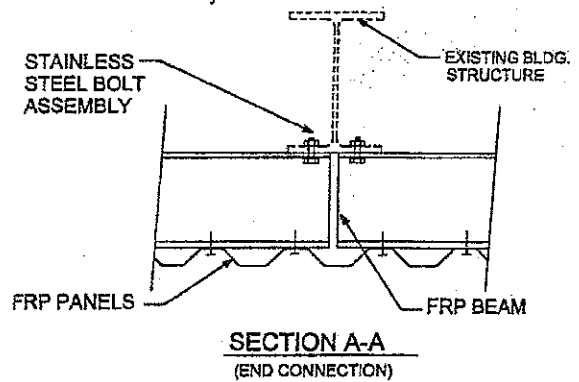
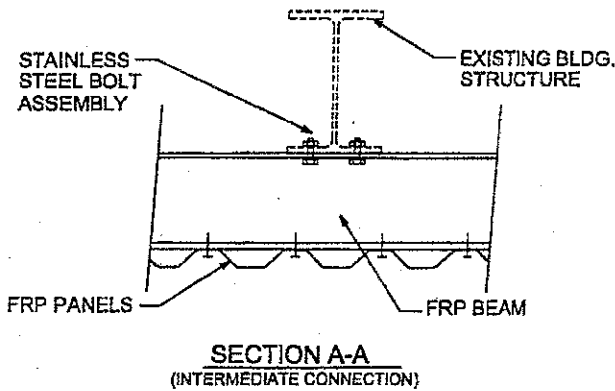
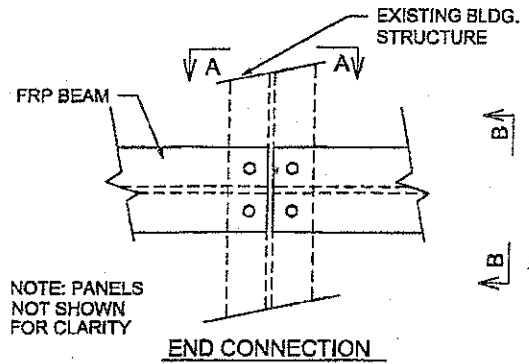
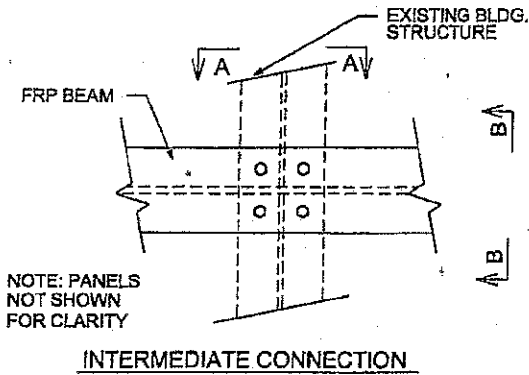
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Product Details

**TYPICAL DETAILS - FRP BEAM ATTACHED TO FLANGES OF
EXISTING BUILDING STRUCTURE**





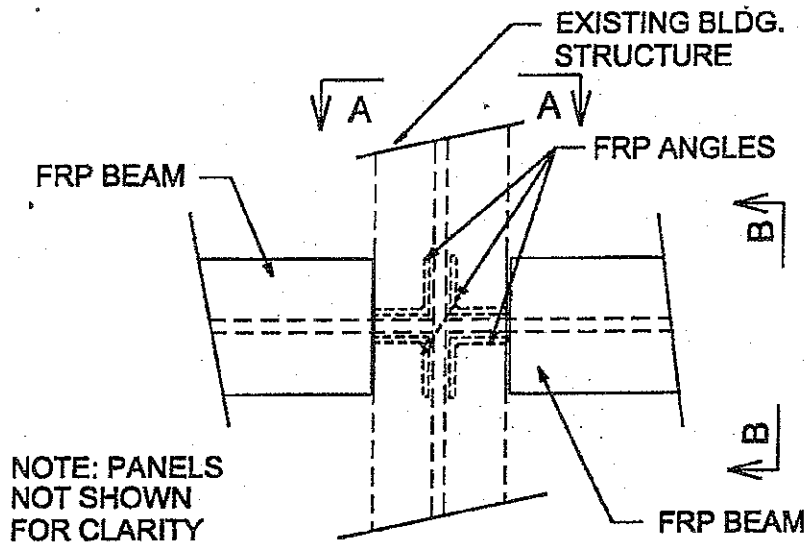
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TECHNICAL DATA

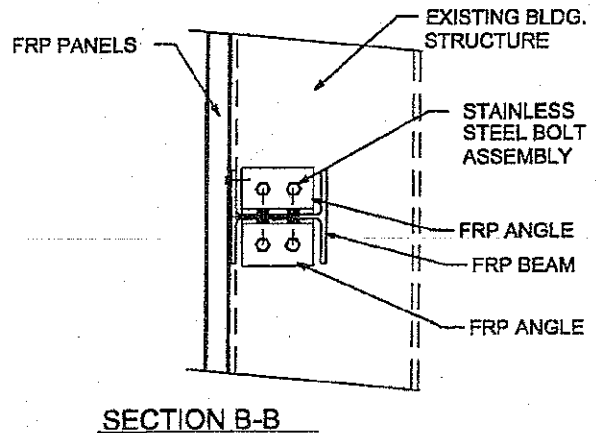
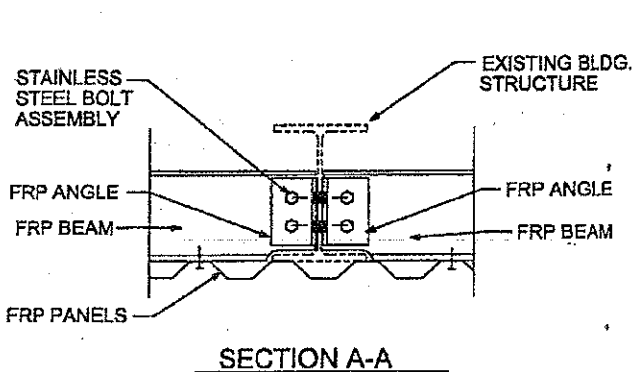
1575 Lebanon School Road • West Mifflin, PA 15122-3464 • Phone 412.466.8611 • Fax 412.466.8640 • www.libertypultrusions.com
1810 Diamond Street • San Marcos, CA 92069 • Phone 760.744.6371 • Fax 760.744.0201

Product Details

**ALTERNATE DETAILS - FRP BEAM ATTACHED TO WEBS OF
EXISTING BUILDING STRUCTURE**



TYPICAL CONNECTION



**LIBERTY
PULTRUSIONS**

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TECHNICAL DATA

MANUFACTURING TOLERANCE

Liberty Pultrusions Composites are manufactured per ASTM D 3917, Standard Specification of Thermosetting Glass-Reinforced Polymer Pultruded Shapes.

STORAGE AND HANDLING

Storage and handling of pultruded shapes shall be done in a manner to protect against physical damage and premature contact with moisture and UV radiation. All pultruded shapes shall be stored to prevent breakage, cuts, cracks, bends, twists, and dents. It is recommended that the pultruded shapes be stored above ground and covered with a waterproof, opaque material.

COLOR NOTICE

Polyester resin products are subject to discoloration when exposed to atmosphere and environmental conditions. Accordingly, seller assumes no responsibility for any loss or damage, direct, indirect, or consequential; or for any change in color for any polyester resin product.

FLAME SPREAD

Liberty Pultrusions advises that the numerical flame spread classification is not intended to reflect hazards presented by this or any other material under actual fire conditions.

STATEMENT OF POLICY

The information provided here is solely based on factual data available to Liberty Pultrusions from many years of experience in manufacturing, field evaluation, testing and research. This is to be used only as a general guide by the designer and builder.

The overall satisfactory performance of any structural application is predicted by proper design and erection. Liberty Pultrusions will not assume any responsibility for the design, detailing, or erections of the FRP Pultrusions.

DISCLAIMER

The information contained herein is for information purposes only. Liberty Pultrusions reserves the right to change or withdraw such information, or the designs and details of the products upon which it is based, either wholly or in any portion thereof, without further notice. For design and detailing assistance on specific products, contact your Liberty Pultrusions sales representative.

MINIMUM ORDER REQUIREMENT

Contact Liberty Pultrusions Customer Service to determine if there is a minimum quantity requirement for the Liberty Pultrusions FRP composite structural shape and resin system you have selected.

TRADEMARKS

Liberty Pultrusions and Polyglas are trademarks of Liberty Polyglas, Inc.



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