

TYPICAL COUPON PROPERTIES

Below are test results for typical coupon properties of Bedford Reinforced Plastics' structural fiberglass profiles (Standard, Fire Retardant, & Vinylester shapes). Properties are derived per the ASTM test method shown. Synthetic surfacing veil and ultraviolet inhibitors are standard.

MECHANICAL PROPERTIES	ASTM	ENGLISH		METRIC	
		Units	Value	Units	Value
Tensile Stress, LW	D-638	psi	30,000	MPa	206.8
Tensile Stress, CW	D-638	psi	7,000	MPa	48.2
Tensile Modulus, LW	D-638	10 ⁶ psi	2.5	GPa	17.2
Tensile Modulus, CW	D-638	10 ⁶ psi	.8	GPa	5.5
Compressive Stress, LW	D-695	psi	30,000	MPa	206.8
Compressive Stress, CW	D-695	psi	15,000	MPa	103.4
Compressive Modulus, LW	D-695	10 ⁶ psi	2.5	GPa	17.2
Compressive Modulus, CW	D-695	10 ⁶ psi	1.0	GPa	6.9
Flexural Stress, LW	D-790	psi	30,000	MPa	206.8
Flexural Stress, CW	D-790	psi	10,000	MPa	68.9
Flexural Modulus, LW	D-790	10 ⁶ psi	1.8	GPa	12.4
Flexural Modulus, CW	D-790	10 ⁶ psi	.8	GPa	5.5
Modulus of Elasticity, E	Full Section	10 ⁶ psi	2.8	GPa	19.3
Shear Modulus	—	10 ⁶ psi	0.450	GPa	3.1
Short Beam Shear	D-2344	psi	4,500	MPa	31.0
Punch Shear	D-732	psi	10,000	MPa	68.9
Notched Izod Impact, LW	D-256	ft.-lbs./in.	25	J/mm	1.33
Notched Izod Impact, CW	D-256	ft.-lbs./in.	4	J/mm	21
PHYSICAL PROPERTIES					
Barcol Hardness	D-2583	—	45	—	45
24 Hour Water Absorbtion	D-570	% max.	0.45	% max.	0.45
Density	D-792	lbs./in. ³	.062-.070	g/cc	1.72-1.94
Coefficient of Thermal Expansion, LW	D-696	10 ⁻⁶ in./in./°F	7	10 ⁻⁶ cm./cm./°C	12
ELECTRICAL PROPERTIES					
Arc Resistance, LW	D-495	seconds	120	seconds	120
Dielectric Strength, LW	D-149	kv./in.	35	kv./mm	1.37
Dielectric Strength, PF	D-149	volts/mil.	200	volts/mil.	200
Dielectric Constant, PF	D-150	@60hz	5	@60hz	5

Fire Retardant Polyester and Fire Retardant Vinylester Structural Profiles:

FLAMMABILITY PROPERTIES	ASTM	Units	Value
Tunnel Test	E-84	Flame Spread	25 max.
Flammability	D-635	—	Nonburning
UL	94	VO	
NBS Smoke Chamber	E-662	Smoke Density	600-700

LW = Lengthwise

CW = Crosswise

PF = Perpendicular to Laminate Face

TEMPERATURE AND WEATHERING

Design Considerations for Fiberglass Pultrusion When Exposed to Continuous High Temperatures

Property loss is experienced in Fire Retardant (FR), Polyester, and Vinylester Fiberglass pultrusion when exposed to continuous high temperatures. The loss of properties should be considered during the designing stages. The following table shows the percentage of property retention at certain continuous temperatures.

	TEMPERATURE	FR/POLYESTER	VINYLESTER
ULTIMATE STRESS	100° F (37°C)	85%	90%
	125° F (51°C)	70%	80%
	150° F (65°C)	50%	80%
	175° F (79°C)	NOT RECOMMENDED	75%
	200° F (93°C)	NOT RECOMMENDED	50%
MODULUS OF ELASTICITY	100° F (37°C)	100%	100%
	125° F (51°C)	90%	95%
	150° F (65°C)	85%	90%
	175° F (79°C)	NOT RECOMMENDED	88%
	200° F (93°C)	NOT RECOMMENDED	85%

Weathering

After exposure to outdoor weathering, almost all plastics undergo some degradation in surface appearance.

The surface of pultrusions typically have good water and ambient temperature resistance, but are attacked by ultraviolet light.

Ultraviolet light is the light spectrum 290 to 400 nanometers. The light has higher energy and can significantly degrade polymers by breaking chemical bonds or starting chemical reactions that lead to polymer degradation. Fire retardant polyester formulations, which contain a halogen, are typically more susceptible to ultraviolet light degradation, due to the halogen additive.

Ultraviolet light will cause the surface of the pultrusion to fade (yellow) and lose gloss. Over a longer period of time, fiberglass closest to the surface will be exposed. This condition is known as fiberbloom. Physical Properties are not affected by this surface degradation.

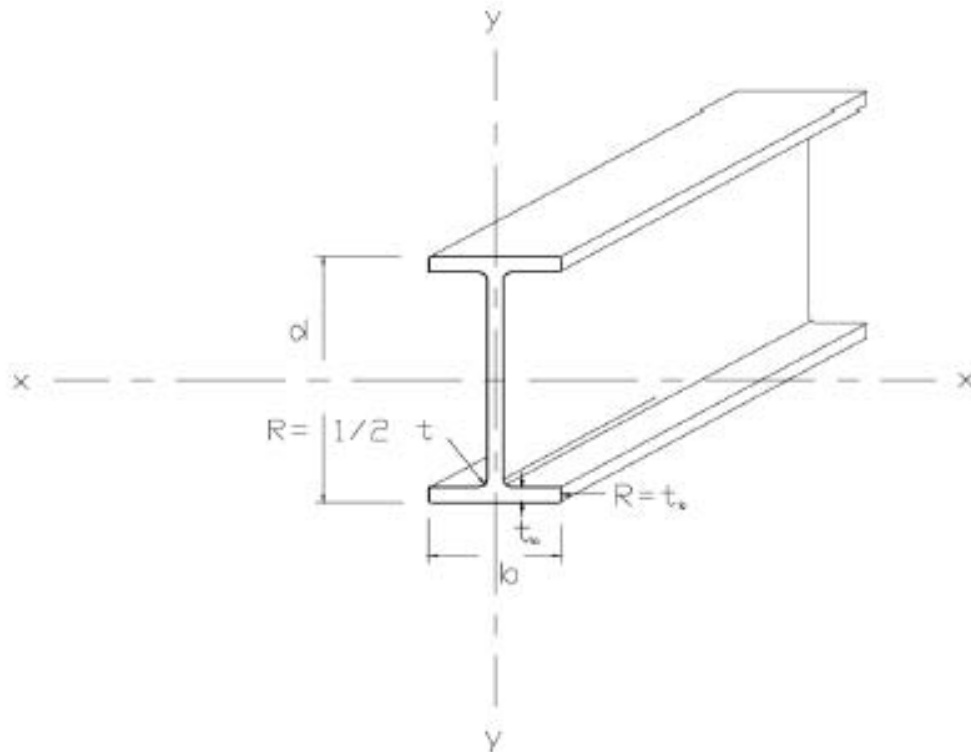
Bedford Reinforced Plastics, Inc. adds a UV stabilizer to our resin mix formulation. This slows the affects of UV degradation. We also incorporate a layer of polyester veil directly to the surface of the pultrusion during processing. This veil gives a resin rich surface and acts as a barrier between the surface and the top layer of fiberglass reinforcement. Pigments used in our resin formulations also slow the effects of weathering. The best method to protect the pultrusion from the effects of outdoor weathering is to apply a protective coating. Urethane based paints can be used.

I-BEAM

SECTION DIMENSIONS						SECTION PROPERTIES											
						X - X			Y - Y								
d, in.	b, in.	t _f , in.	t _w , in.	A, in. ²	Wt. lb./ft.	I in. ⁴	S in. ³	r in.	I in. ⁴	S in. ³	r in.	J in. ⁴	h in.	A in. ²	C in.	C in.	
mm.	mm.	mm.	mm.	mm. ²	kg./m.	mm. ⁴	mm. ³	mm.	mm. ⁴	mm. ³	mm.	mm. ⁴	mm.	mm. ²	mm.	mm.	
3	1.5	0.25	1/4	1/4	1.38	1.75	1.16	1.13	0.14	0.19	0.32	0.029	2 1/2	0.625	0.75	1.50	
76.2	38.1	6.35	6.35	886.89	1.60	727321.06	19689.79	28.63	59887.46	1143.70	8.22	11923.30	63.50	403.23	19.05	38.10	
3.5	1.5	3/16	3/16	1.15	0.90	2.02	1.16	1.33	0.11	0.14	0.31	0.013	3 1/8	0.580	0.75	1.75	
88.90	38.10	4.76	4.76	740.74	1.33	841418.03	18929.54	33.70	44613.92	2341.94	7.76	5601.75	79.38	378.02	19.05	44.45	
4	2	1/4	1/4	1.88	1.46	4.41	2.21	1.53	0.34	0.34	0.42	0.039	3.5	0.875	1.00	2.00	
101.60	50.80	6.35	6.35	1309.38	2.18	1837271.53	36166.76	38.97	140640.70	5537.04	10.78	16259.04	88.90	564.52	25.40	50.80	
5.5	2.5	1/4	1/4	2.50	1.95	11.22	4.08	2.12	0.66	0.53	0.51	0.052	5	1.25	1.25	2.75	
139.70	63.50	6.35	6.35	1612.50	2.91	4673764.18	66882.81	53.82	273693.84	8620.28	13.03	21678.72	127.00	806.45	31.75	69.85	
6	3	1/4	1/4	2.88	2.24	15.87	5.29	2.35	1.13	0.75	0.63	0.060	5 1/2	1.375	1.5	3.00	
152.40	76.20	6.35	6.35	1854.38	3.34	6606589.95	86700.66	59.68	471241.18	12368.53	15.94	24930.53	139.70	887.10	38.10	76.20	
6	3	3/8	3/8	4.22	3.29	22.35	7.45	2.30	1.71	1.14	0.64	0.198	5 1/4	1.969	1.5	3.00	
152.40	76.20	9.53	9.53	2721.09	4.90	9301197.11	122062.82	58.46	711993.33	18467.49	16.17	82311.39	133.35	1270.16	38.10	76.20	
8	4	3/8	3/8	5.72	4.46	55.55	13.89	3.12	4.03	2.02	0.84	0.268	7 1/4	2.719	2.00	4.00	
203.20	101.60	9.53	9.53	3688.50	6.65	23121371.16	217572.55	79.16	1678186.98	33035.18	21.33	111577.66	184.15	1754.03	50.80	101.60	
8	4	1/2	1/2	7.50	5.85	70.63	17.66	3.07	5.41	2.70	0.85	0.625	7	3.500	2.00	4.00	
203.20	101.60	12.70	12.70	4837.50	8.72	29396344.43	289334.10	77.94	2250251.14	44296.28	21.57	260144.64	177.80	2258.06	50.80	101.60	
10	5	3/8	3/8	7.22	5.63	111.63	21.33	3.93	7.85	3.14	1.04	0.338	9 1/4	3.469	2.50	5.00	
254.00	127.00	9.53	9.53	4656.09	8.39	46462849.07	365249.21	98.88	3268727.58	51476.02	26.49	140343.93	234.95	2237.90	63.50	127.00	
10	5	1/2	1/2	9.50	7.41	143.29	28.66	3.88	10.51	4.20	1.05	0.792	9	4.500	2.50	5.00	
254.00	127.00	12.70	12.70	6127.50	11.04	59612494.69	469625.94	98.65	4374765.71	68893.95	26.72	329516.35	228.60	2993.22	63.50	127.00	
12	6	1/2	1/2	11.50	8.97	253.96	42.33	4.70	18.11	6.04	1.26	0.958	11	5.500	3.00	6.00	
304.80	152.40	12.70	12.70	7417.50	13.37	105705439.13	693695.24	119.36	7539858.84	98948.28	31.85	398888.45	279.40	3548.38	76.20	152.40	
*18	4 1/2	1/2	3/8	10.88	8.48	498.16	55.35	6.77	7.67	3.41	0.84	0.674	17	6.375	2.25	9.00	
*457.20	114.30	12.70	9.53	7014.38	12.64	207348286.11	907035.37	171.91	3191852.80	55850.44	21.33	280468.44	431.80	4112.90	57.15	228.60	
*24	7 1/2	3/4	3/8	19.60	15.36	1876.82	156.40	9.76	52.83	14.09	1.64	2.505	22 1/2	8.438	3.75	12.00	
*609.6	180.5	19.05	9.53	12698.44	23.88	781189968.26	7563959.21	248.00	21000859.78	230875.17	41.61	7042610.84	571.50	5443.54	95.25	284.80	

- *18" I Beam - Web = 3/8" Flange = 1/2"
- *457.20 I Beam - Web = 9.53mm Flange = 12.70mm
- *24" I Beam - Web = 3/8" Flange = 3/4"
- *609.60 I Beam - Web = 9.53mm Flange = 19.05mm
- *ENGLISH

METRIC



3 X 1 1/2 X 1/4 I-BEAM

76.2 x 38.1 x 6.41 I-BEAM

ALLOWABLE UNIFORM LOADS (lbs./ft. / N/m.) Laterally Supported

$$A_w = 0.63 \text{ in.}^2 / 403.2 \text{ mm.}^2$$

$$I = 1.75 \text{ in.}^4 / 728405 \text{ mm.}^4$$

$$\text{Wt.} = 1.10 \text{ lbs./ft.} / 1.64 \text{ kg/m.}$$

$$S = 1.17 \text{ in.}^3 / 19173 \text{ mm.}^3$$

SPAN FT/m	NO LATERAL SUPPORT MAX LOAD	LATERALLY SUPPORTED						
		MAXIMUM LOAD		DEFLECTION				
				L/100	L/150	L/180	L/240	L/360
4/1.22	102/1488	468/6825	F_v	355/5188	237/3453	197/2875	147/2152	98/1429
5/1.52	50/724	311/4537	F_b	190/2776	126/1845	105/1535	79/1147	52/759
6/1.83	28/403	216/3146	F_b	113/1643	75/1090	62/905	46/675	30/445
7/2.13	17/244	158/2307	F_b	72/1046	47/692	39/574	29/426	19/279
8/2.44	11/156	121/1762	F_b	48/703	32/463	26/383	19/283	13/184
9/2.74	7/104	95/1389	F_b	34/493	22/323	18/266	13/196	9/125
10/3.05	5/71	77/1122	F_b	24/357	16/237	13/191	10/139	6/87

The part weight has been deducted in the above table.

English/Metric

At the time of this printing, this was a non-stocked item.

The mill run on this item is 1,400 feet.

Orders for less than mill run quantities will be subject to set-up charges as well as premium per foot cost.

