Since 1974
BEDFORD
REINFORCED PLASTICS®

PROForms® Structural Shapes

Bedford occupies over 200,000 sq. ft. of manufacturing space including a state-of-the-art fabrication center at our central Pennsylvania headquarters.

For more than 40 years, Bedford has built its reputation for service and reliability by helping customers solve their toughest challenges. We're still the same family-owned-and-operated company that began in 1974, and our PROForms® FRP products continue to be made in the USA under controlled quality-assurance conditions. We'll never put our customers at the risk of longer lead times, improper specs, and far-away product support like foreign producers do. When you work with Bedford, you can expect quality products at a fair price without restrictive policies, hidden conditions or hassles.

Special Orders and Requests Welcome

From different colors and specific tolerances to unusual reinforcement needs and custom FRP structural shapes, our decades of experience meeting specific requirements on custom orders means you'll get exactly what you need. Volume discounts and annual contracts are also available, so contact us for a quote.

Quality and Testing

Need to know a specific product will perform as you require? We have detailed technical data, application history and over 40 years of experience to help ensure you get the right structural fiberglass and composite grating products for your application. We also have an in-house testing facility to confirm the product performs to your required specs.

Reasons to Choose Bedford

NATIONWIDE LOGISTICS AND WAREHOUSING

We have distribution locations across the U.S. to expedite delivery and can stagger shipments to fit your installation schedule.

GUARANTEED READY-TO-SHIP DATES

When you receive a ready-to-ship date from Bedford, it's guaranteed*. If we miss the promised ship date, we pay significant penalties back to you. We also offer Express Response options with shorter, guaranteed lead times.

25-YEAR LIMITED WARRANTY

PROForms® products are warranted against manufacturing defects for an industry-leading 25 years.*

FABRICATION & ASSEMBLY

Bedford has a state-of-the-art fabrication facility with CNC machines for faster processing, as well as secondary coating and painting services. Kitted shipments are available to save installation time on site.

DESIGN AND ENGINEERING SERVICES

Our full-service team can assist with design, engineering, drafting and estimating to maximize the advantages of FRP in your project.

* Terms and conditions apply. Download our complete guarantee and warranty at bedfordreinforced.com. Ship date guarantees available in most areas. Ask Bedford for details.

THE SMART ALTERNATIVE TO WOOD, STEEL AND ALUMINUM

Fiberglass reinforced polymer (FRP) is one of the strongest, most durable building materials available today. It's nonconductive, dimensionally stable and extremely low maintenance. It offers the strength of steel at a fraction of the weight for efficient transportation and installation. And unlike traditional materials like wood, steel and aluminum, FRP won't rust, corrode, warp, rot, decay or attract insect damage — so it's ideal for harsh environments.

In short, it's a different way to solve your design challenges — one that can reduce costs and improve long-term performance. To maximize these benefits, however, it's best to design with the properties of FRP in mind from the start. Our engineers and fabricators can help, so contact us with your questions.

Features and Benefits

- **Corrosion resistant.** Won't rot, rust or corrode.
- **Strong yet lightweight.** Helps save on transportation.
- **Virtually maintenance-free.** Durable and weather-resistant for a longer life cycle.
- **Fire-retardant and nonconductive.** Helps create a safer environment.
- **Dimensionally stable.** Won't shrink, swell, warp or bow.
- **Highly consistent.** Strength, appearance and quality are the same from piece to piece.
- **Easy to fabricate and install.** FRP can be cut, drilled and assembled with standard tools.
- **Non-leaching.** Does not require environmentally hazardous preservatives.
- **Fast turnaround.** Most in-stock orders are shipped within the next business day.
- **Backed by a 25-Year Limited Warranty***
- **Made in U.S.A.**

APPLICATIONS

Stair Structures
Walkways
Pedestrian Bridges
Structural Framing
Handrail Systems
Caged and Fixed Ladders
Decking
Boat Docks
Pipe Supports
Cross Bracing
Concrete Embedment
Tank and Hatch Covers
Display Racks

MARKETS

Architectural Solutions
Agriculture
Cooling Towers
Military
Mining
Oil and Gas
Pedestrian Bridges
Plant and Chemical Processing
Pulp and Paper
Theme and Water Parks
Utilities
Wastewater/Water Treatment

FRP vs. Traditional Materials

Traditional building materials have their place. But for harsh, corrosive environments, FRP is a smart choice. Here's how FRP compares to several traditional options.

	FRP Composites *Pultruded GFRP*	**Steel** *A 709 Grade 50*	**Aluminum** *6061-T651 & 6061-T6*	**Wood** *Douglas Fir*
CORROSION, ROT AND INSECT RESISTANCE	**Resists a broad range of chemicals and is unaffected by moisture** or immersion in water. **Resists insect damage.** Painting is only suggested when exposed to UV rays/direct sunlight.	Subject to oxidation and corrosion. Requires painting or galvanizing for many applications.	Can cause galvanic corrosion. (Anodizing and other coatings increase corrosion resistance.)	Can warp, rot and decay when exposed to moisture, water and chemicals. Susceptible to attack by insects such as termites and marine borers.
STRENGTH	**Has greater flexural strength** than timber and pound-for-pound is **often stronger than steel and aluminum** in the lengthwise direction. Ultimate flexural strength (F_u): LW = 30,000 psi (30 ksi) CW = 10,000 psi (10 ksi) Compression strength: LW = 30,000 psi (30 ksi) CW = 15,000 psi (10 ksi)	Homogeneous material. Yield strength (F_y) = 36 ksi	Homogeneous material. Flexural strength (F_u) = 35 ksi	Modulus of rupture is 12,000 psi
WEIGHT	Weighs 75% less than steel and 30% less than aluminum.	Could require lifting equipment to move and place. 1/2-in. thick plate = 20.4 lbs/sq ft	Lightweight – about a third of the weight of copper or steel.	Specific gravity 0.48
ELECTRICAL CONDUCTIVITY	**Nonconductive.** High dielectric capability.	Conducts electricity. Grounding potential.	Conducts electricity. Grounding potential.	Can be conductive when wet.
THERMAL PROPERTIES	**Good insulator with low thermal conductivity.** Thermal conductivity = 4 (BTU in. /(hr ft^2 °F) Low thermal coefficient of expansion. = 7 - 8 (in./in./°F) 10^{-6}	Conducts heat. Thermal conductivity = 260-460 (BTU/sf/hr/°F/in.) Thermal coefficient of expansion. = 6 - 8 (in./in./°F) 10^{-6}	Conducts heat. Thermal conductivity = 150 (BTU/sf/hr/°F/in.) Thermal coefficient of expansion. = 13 (in./in./°F) 10^{-6}	Low thermal conductivity. Thermal conductivity = .8 (BTU/sf/hr/°F/in.) Thermal coefficient of expansion. = 1.7 - 2.5 (in./in./°F) 10^{-6}
STIFFNESS	**Up to 3.3 times as rigid as timber. Will not permanently deform under working load.** Modulus of elasticity: 2.8 x 10^6 psi	Modulus of elasticity: 29 x 10^6 psi	Modulus of elasticity: 10 x 10^6 psi	Modulus of elasticity: up to 1.6-1.8 x 10^6 psi*

	FRP Composites *Pultruded GFRP*	Steel *A 709 Grade 50*	Aluminum *6061-T651 & 6061-T6*	Wood *Douglas Fir*
IMPACT RESISTANCE	**Will not permanently deform under impact.** Glass mat in pultruded parts distributes impact load to prevent surface damage, even in subzero temperatures.	Can permanently deform under impact.	Easily deforms under impact.	Can permanently deform or break under impact.
ENVIRONMENTAL IMPACT	**Not hazardous to the environment.**	Not hazardous.	Not hazardous.	May be treated with hazardous preservatives or coatings to increase corrosion/rot/insect resistance. Contributes to depletion of forest systems.
COLOR	**Color is molded through; no painting required.** Variety of colors available.	Must be painted for color, and may require repainting over time.	Colors require prefinishes, anodic coatings and paints. Mechanical, chemical and electroplated finishes can be applied.	Must be primed and painted for color, and may require repainting over time.
COST	**Lower installation costs, less maintenance and longer product life allow for a lower lifecycle cost.**	Lower initial material cost.	Part price comparable to FRP.	Has a lower initial cost, but usually requires more maintenance and replacement.
EMI/RFI TRANSPARENCY	**Transparent to radio waves and EMI/RFI transmissions.** Used for radar and antennae enclosures and supports.	Can interfere with EMI/RFI transmissions.	Highly reflective to EMI/RFI transmissions.	Transparent.
FABRICATION	**Can be field-fabricated using simple carpenter's tools** with carbon or diamond tip blades — no torches or welding required. Light weight allows easier transport and installation.	Often requires welding and cutting torches. Heavier material requires special equipment to erect and install.	Good machinability (welding, brazing, soldering or mechanical joining).	Can be field-fabricated using simple carpenter's tools.

*12% moisture content

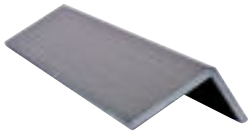
Compare the Numbers ...

Properties	FRP Composites *Pultruded GFRP*		Steel *A 709 Grade 50*	Aluminum *6061-T651 & 6061-T6*	Wood *Douglas Fir*
Density (lb/ft^3)	107-120		490	169	30
Tensile Strength (psi)	30,000 (LW)	7,000 (CW)	65,000	45,000	–
Tensile Modulus (x 10^6 psi)	2.8 (LW)	1 (CW)	30	10	–
Flexural Strength (psi)	30,000 (LW)	10,000 (CW)	65,000	45,000	12,000
Flexural Modulus (x 10^6 psi)	1.8 (LW)	0.8 (CW)	30	10	1.6 - 1.8
Thermal Conductivity (BTU in. /(hr ft^2 °F))	4		323	1,160	0.8
Thermal Expansion (x 10^{-6} in./in./°F)	7 to 8		6 to 8	13	1.7 to 2.5

LW = Lengthwise / CW = Crosswise

References:
1. Datasheets from www.matweb.com
2. Wood Handbook: Wood as an Engineering Material

PROForms® Availability



ANGLE

SIZE IN INCHES	LBS./LIN. FT.
1 x 1 x ⅛	0.19
1½ x 1½ x 3/16	0.46
1½ x 1½ x ¼	0.54
2 x 2 x ¼	0.75
3 x 3 x ¼	1.16
3 x 3 x ⅜	1.62
4 x 4 x ¼	1.50
4 x 4 x ⅜	2.21
4 x 4 x ½	2.92
6 x 6 x ⅜	3.35
6 x 6 x ½	4.55

CHANNEL

SIZE IN INCHES	LBS./LIN. FT.
2 x 9/16 x ⅛	0.28
3 x ⅞ x ¼	0.80
3 x 1 x ¼	0.85
3 x 1½ x 3/16	0.81
3 x 1½ x ¼	1.03
3½ x 1½ x 3/16	0.90
3½ x 1½ x ¼	1.17
4 x 1⅛ x ¼	1.14
4 x 1⅜ x 3/16	0.93
5 x 1⅜ x ¼	1.37
5½ x 1½ x ¼	1.55
6 x 1⅝ x ¼	1.69
6 x 1 11/16 x ⅜	2.41
8 x 2 3/16 x ¼	2.31
8 x 2 3/16 x ⅜	3.24
10 x 2¾ x ½	5.41
11½ x 2¾ x ½	6.24
12 x 3 x ½	6.44
14 x 3½ x ¾	10.97
18 x 2½ x ⅜	6.50

SQUARE TUBE

SIZE IN INCHES	LBS./LIN. FT.
1 x 1 x ⅛	0.34
1¼ x 1¼ x ⅛	0.39
1¼ x 1¼ x ¼	0.74
1½ x 1 ½ x ⅛	0.53
1½ x 1½ x ¼	0.97
1¾ x 1¾ x ⅛	0.58
1¾ x 1¾ x ¼	1.09
2 x 2 x ⅛	0.71
2 x 2 x ¼	1.35
2¼ x 2¼ x ⅛	0.86
2¼ x 2¼ x ¼	1.67
2½ x 2½ x ¼	1.76
3 x 3 x ⅛	1.09
3 x 3 x ¼	2.11
3 x 3 x ⅜	2.99
3½ x 3½ x ¼	2.60
3½ x 3½ x ⅜	3.80
4 x 4 x ¼	2.96
4 x 4 x ⅜	4.32
6 x 6 x ¼	4.35
6 x 6 x ⅜	6.54

FLAT SHEET

SIZE IN INCHES	LBS./LIN. FT.
3/16 x 2½	0.37
¼ x 3	0.57
⅜ x 3	0.93
½ x 3	1.03
⅛ x 4	0.39
¼ x 4	0.76
⅜ x 4	1.15
½ x 4	1.53
¼ x 6	1.24
½ x 6	2.25
¼ x 9	1.86
¼ x 10	1.90
¼ x 11	2.26
¼ x 12	2.46
¼ x 24	4.87
¼ x 36	7.49

SIZE IN INCHES	LBS./SQ. FT.
⅛ x 48	1.30
3/16 x 48	1.88
¼ x 48	2.49
⅜ x 48	3.51
½ x 48	4.87
⅝ x 48	5.86
¾ x 48	6.72
1 x 48	8.65

ROUND TUBE

SIZE IN INCHES	LBS./LIN. FT.
1 x .100	0.25
1 x ⅛	0.28
1½ x ⅛	0.38
1½ x ¼	0.79
1¾ x ⅛	0.53
1¾ x ¼	0.97
2 x ⅛	0.57
2 x ¼	1.03
3 x .100	0.70
3 x ¼	1.72
3 x ½	3.13
4.89 x ⅛	1.81
4.89 x 3/16	2.13

I-BEAM

SIZE IN INCHES	LBS./LIN. FT.
3½ x 1½ x 3/16	0.97
4 x 2 x ¼	1.56
5½ x 2½ x ¼	1.58
6 x 3 x ¼	2.34
6 x 3 x ⅜	3.65
8 x 4 x ⅜	4.42
8 x 4 x ½	5.70
10 x 5 x ½	7.39
12 x 6 x ½	8.91
18 x ⅜ x 4½ x ½	8.51
24 x ⅜ x 7½ x ¾	15.49

WIDE FLANGE (WF) BEAM

SIZE IN INCHES	LBS./LIN. FT.
4 x 4 x ¼	2.33
6 x 6 x ¼	3.49
6 x 6 x ⅜	5.29
8 x 8 x ⅜	6.92
8 x 8 x ½	8.85
10 x 10 x ½	11.08
12 x 12 x ½	13.43

ROUND ROD

SIZE IN INCHES	LBS./LIN. FT.
⅛	0.01
3/16	0.02
¼	0.04
5/16	0.07
⅜	0.10
½	0.16
⅝	0.27
¾	0.38
⅞	0.52
1	0.68
1¼	1.07
1½	1.53
2	2.56

CHECK WEBSITE FOR AVAILABILE INVENTORY Most in-stock orders are shipped within the next business day.

SLUDGE FLIGHTS

SIZE IN INCHES	LBS./LIN. FT.
3 x 6 x ⅛ x 3/16 (Channel)	1.37
3 x 8 x ⅛ x 3/16 (Channel)	1.50
6 x ⅛ x 3 x ¼ (Angle)	1.28
8 x ⅛ x 3 x ¼ (Angle)	1.66

EMBEDMENT ANGLE

SIZE IN INCHES	LBS./LIN. FT.
1 x 1½ x ¼	0.95
1½ x 1½ x ¼	1.06
2 x 1½ x ¼	1.15

DECK BOARD

SIZE IN INCHES	LBS./LIN. FT.
12 x 2⅛ x 3/16	2.97
24 x 1⅛ x various thickness	4.61
24 x 1½ x .175	5.96

BUILDING PANEL — 12"/24"

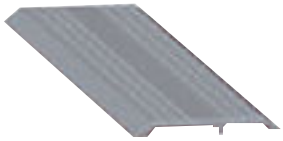
SIZE IN INCHES	LBS./LIN. FT.
12 x 1 25/32 x 3/32	2.67
24 x 2½ x ¼	13.31

DOOR FRAME

SIZE IN INCHES	LBS./LIN. FT.
5¾ x 2⅝ x 3/16	1.68

BOX BEAM — 16"

SIZE IN INCHES	LBS./LIN. FT.
16 x 4 x ⅜	11.41
16 x 4 x ¼	9.00



THRESHOLD

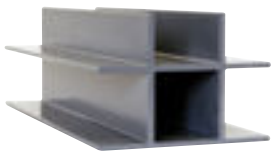
SIZE IN INCHES	LBS./LIN. FT.
5½ x ¼	1.07

SQUARE BAR

SIZE IN INCHES	LBS./LIN. FT.
1 x 1	0.81
1¼ x 1¼	1.13
1½ x 1½	1.87
2 x 2	3.32

CORNER COLUMN

SIZE IN INCHES	LBS./LIN. FT.
7¾ x 7¾ x ⅜	8.81



CENTER COLUMN

SIZE IN INCHES	LBS./LIN. FT.
7¾ x 10¾ x ⅜	10.68

LADDER RUNG

SIZE IN INCHES	LBS./LIN. FT.
1¼ x .160	0.50

HANDRAIL CONNECTORS

SIZE IN INCHES	LBS./PIECE
4¼ x 1¼ Fixed	0.87
4½ x 1½ Fixed	1.32
4¼ x 1¼ Adjustable	0.87
4½ x 1½ Adjustable	1.32

THREADED ROD & HEX NUTS

SIZE IN INCHES	LBS./LIN. FT.
Rod — ⅜-16 UNC	0.10
Rod — ½-13 UNC	0.15
Rod — ⅝-11 UNC	0.24
Rod — ¾-10 UNC	0.34
Rod — 1-8 UNC	0.52
Hex Nut — ⅜-16 UNC	0.02
Hex Nut — ½-13 UNC	0.02
Hex Nut — ⅝-11 UNC	0.04
Hex Nut — ¾-10 UNC	0.07
Hex Nut — 1-8 UNC	0.13

Threaded rod available in 48" & 96" lengths.

TOE PLATE

SIZE IN INCHES	LBS./LIN. FT.
4 x ⅝ x ⅛	0.49

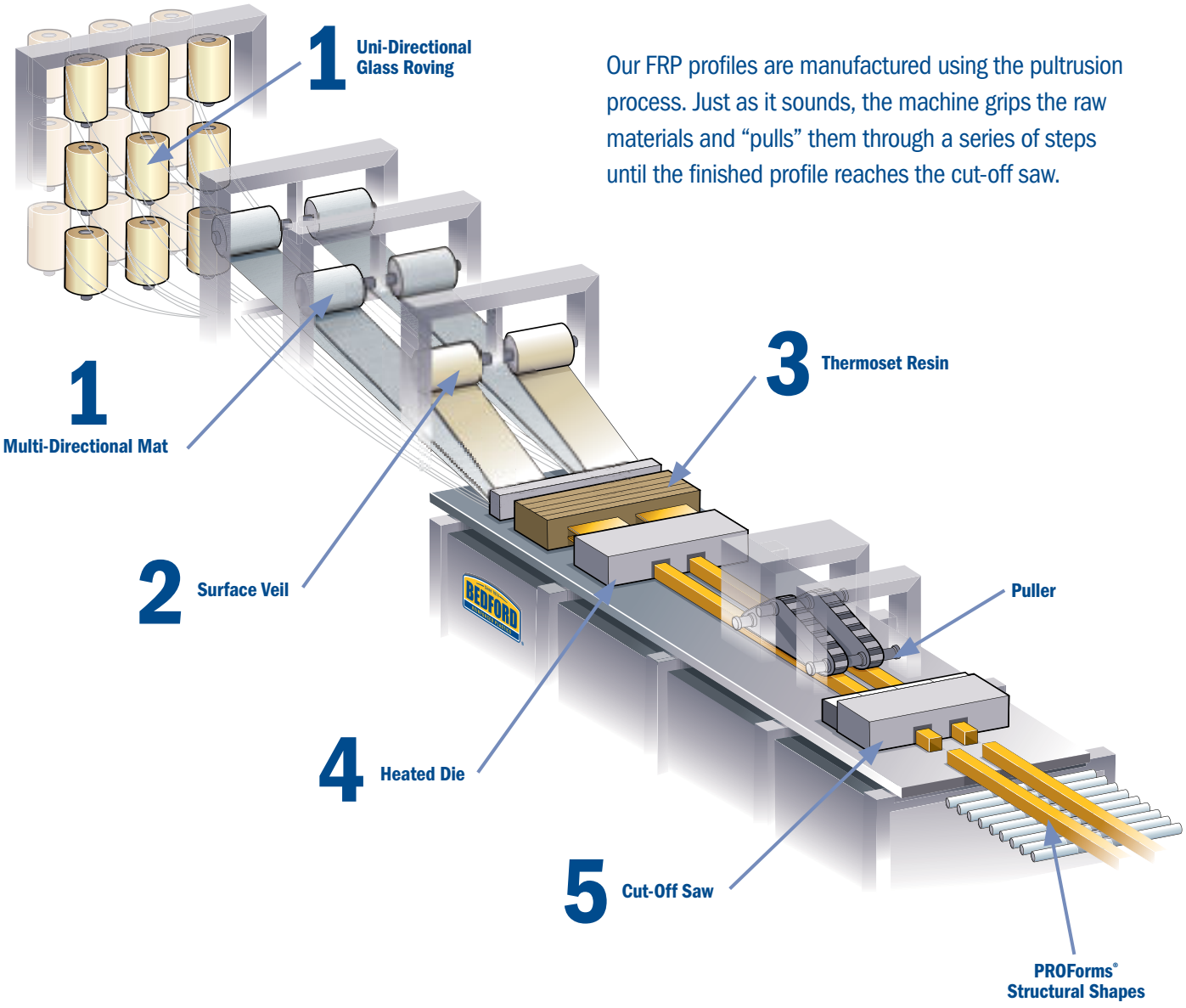
RECTANGULAR TUBE

SIZE IN INCHES	LBS./LIN. FT.
4 x ⅛ x 1 x ⅛	1.49
4 x ⅛ x 2 x ¼	1.49
4 x ¼ x 2 x ¼	1.58
5½ x ¼ x 3½ x ¼	3.09
6 x ¼ x 4 x ¼	3.77
6½ x ¼ x 2 x ½	3.56

FLAT STRIP

SIZE IN INCHES	LBS./LIN. FT.
1 x ⅛	0.11
1¼ x 3/16	0.19
1¾ x ¼	0.39
2 x ½	0.85

The Pultrusion Process: Step by Step



Our FRP profiles are manufactured using the pultrusion process. Just as it sounds, the machine grips the raw materials and "pulls" them through a series of steps until the finished profile reaches the cut-off saw.

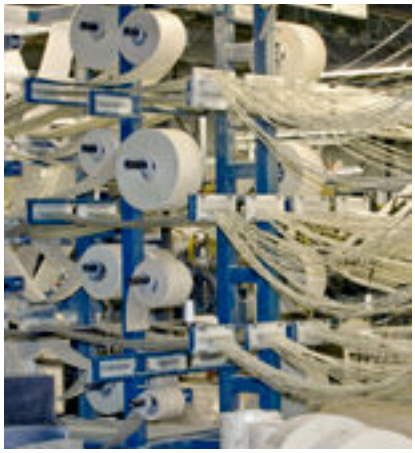
FRP is also known as "composites," and is a combination of:

REINFORCEMENTS such as fiberglass roving and mat;

RESIN such as polyester or vinylester;

ADDITIVES such as pigments, UV inhibitors, fire retardant, etc.; and

SURFACE VEIL which enhances corrosion resistance, UV protection and appearance



1 Reinforcement

The process typically starts by pulling in two forms of fiberglass reinforcement. Creels of fiberglass roving provide unidirectional strength along the length of the profile, and rolls of woven fiberglass mat provide multidirectional reinforcement. All reinforcements are fed through pre-forming guides that will begin to shape the raw glass fibers into the finished profile.

2 Surface Veil

Surface veil can be added to enhance the surface appearance and provide corrosion resistance and UV protection of the final product.

3 Wet-Out

The fiberglass reinforcements are pulled through a bath of thermoset resin — typically polyester or vinylester — as well as pigments to add color, filler to enhance properties, and a catalyst to aid in curing. Resin also provides an additional form of reinforcement.

4 Curing

Wet-out reinforcements are pulled through the heated pultrusion die, which begins the thermosetting process that causes the resin to “cure” or harden. By the time the part exits the die, a solid, rigid profile in the exact shape of the die cavity has been formed with all the reinforcements laminated inside.

5 Cutting

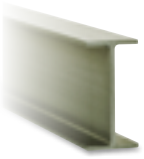
The finished product is then pulled to the cut-off saw and cut to the desired length. After cutting, it is placed in stock at one of our warehouses, sent to our state-of-the-art fabrication center for secondary processing, or crated for shipment to the customer.

Standard Resin Systems

PROForms® products are offered in three resin series to meet the requirements of different applications and environments.

STD — STANDARD NON FIRE RETARDANT POLYESTER

A general-purpose isophthalic polyester resin system with a UV inhibitor, offering good corrosion resistance. Color: Olive Green



FR — FIRE RETARDANT POLYESTER

A general-purpose fire-retardant isophthalic resin system with a UV inhibitor, offering good corrosion resistance. Colors: Dark Gray and Yellow

VE — VINYLESTER FIRE RETARDANT

A premium vinylester resin system with a UV inhibitor. It’s fire retardant and highly corrosion resistant.
Colors: Beige and Yellow

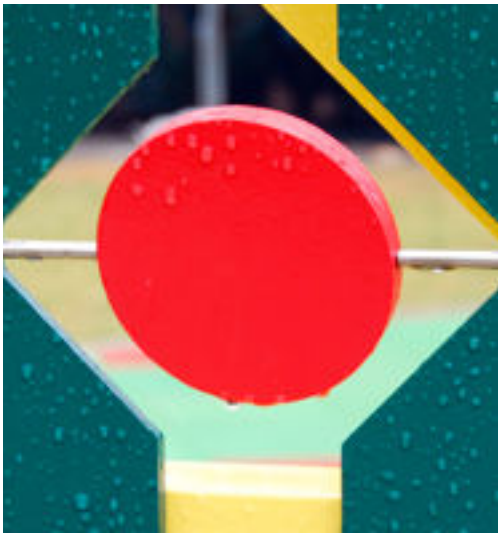
Typical Coupon Properties

The following table shows test results for typical coupon properties of PROForms® structural fiberglass profiles (Standard, Fire Retardant and Vinylester shapes). Properties are derived per the ASTM test method shown. Synthetic surfacing veil and ultraviolet inhibitors are standard.

	ASTM Test Method	Units	Polyester PROForms	Vinylester PROForms	Rod & Bar PROForms	Polyester Flat Sheet			Vinylester Flat Sheet		
						1/8"	3/16" – 1/4"	3/8" – 1"	1/8"	3/16" – 1/4"	3/8" – 1"
MECHANICAL PROPERTIES (minimum ultimate)											
Tensile Stress, LW	D-638	psi	30,000	30,000	100,000	20,000	20,000	20,000	20,000	20,000	20,000
		N/mm^2	206.8	206.8	689	137.9	137.9	137.9	137.9	137.9	137.9
Tensile Stress, CW	D-638	psi	7,000	7,000		7,500	10,000	10,000	7,500	10,000	10,000
		N/mm^2	48.2	48.2		51.7	68.9	68.9	51.7	68.9	68.9
Tensile Modulus, LW	D-638	10^6 psi	2.5	2.6	6.0	1.8	1.8	1.8	1.8	1.8	1.8
		KN/mm^2	17.2	17.9	41.3	12.4	12.4	12.4	12.4	12.4	12.4
Tensile Modulus, CW	D-638	10^6 psi	0.8	0.8		0.7	0.9	1.4	1.0	1.0	1.4
		KN/mm^2	5.5	5.5		4.8	6.2	9.6	6.9	6.9	9.6
Compressive Stress, LW	D-6641	psi	30,000	30,000	60,000	24,000	24,000	24,000	24,000	24,000	24,000
		N/mm^2	206.8	206.8	413.6	165.4	165.4	165.4	165.4	165.4	165.4
Compressive Stress, CW	D-6641	psi	15,000	16,000		15,500	16,500	20,000	16,500	17,500	20,000
		N/mm^2	103.4	110.3		106.8	113.7	137.9	113.79	120.6	137.9
Compressive Modulus, LW	D-6641	10^6 psi	2.5	2.6		1.8	1.8	1.8	1.8	1.8	1.8
		KN/mm^2	17.2	17.9		12.4	12.4	12.4	12.4	12.4	12.4
Compressive Modulus, CW	D-6641	10^6 psi	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
		KN/mm^2	6.9	6.9		6.9	6.9	6.9	6.9	6.9	6.9
Flexural Stress, LW	D-790	psi	30,000	30,000	100,000	35,000	35,000	30,000	35,000	35,000	30,000
		N/mm^2	206.8	206.8	689	241.3	241.3	206.8	241.3	241.3	206.8
Flexural Stress, CW	D-790	psi	10,000	10,000		13,000	15,000	18,000	13,000	15,000	18,000
		N/mm^2	68.9	68.9		89.6	103.4	124.1	89.6	103.4	124.1
Flexural Modulus, LW	D-790	10^6 psi	1.8	2.2	6.0	1.8	2.0	2.0	1.8	2.0	2.0
		KN/mm^2	11.0	11.0	41.9	12.4	13.8	13.8	12.4	13.8	13.8
Flexural Modulus, CW	D-790	10^6 psi	0.8	0.8		0.9	1.1	1.4	1.0	1.1	1.4
		KN/mm^2	5.5	5.5		6.2	7.6	9.6	6.2	7.6	9.6
Modulus of Elasticity, E	Full Section	10^6 psi	2.6	2.8							
		KN/mm^2	17.9	19.3							
Modulus of Elasticity, E (W & I Shapes > 4")	Full Section	10^6 psi	2.5	2.5							
		KN/mm^2	17.2	17.2							
Shear Modulus, LW	D-5379	10^6 psi	0.425	0.425							
		KN/mm^2	2.9	2.9							
Short Beam Shear, LW	D-2344	psi	4,500	4,500	8,000						
		N/mm^2	31.0	31.0	55.2						
Bearing Stress, LW & CW	D-953	psi	30,000	30,000		32,000	32,000	32,000	32,000	32,000	32,000
		N/mm^2	206.8	206.8		220.6	220.6	220.6	220.6	220.6	220.6
Poisson's Ratio, LW	D-3039	in./in.	0.33	0.33		0.31	0.31	0.31	0.31	0.31	0.31
		mm/mm	0.33	0.33		0.31	0.31	0.31	0.31	0.31	0.31
Notched Izod Impact, LW	D-256	ft.-lbs./in.	25	25	40	18.5	20	20	18.5	20	20
		J/mm	1.33	1.33	2.13	0.98	1.06	1.06	0.98	1.06	1.06
Notched Izod Impact, CW	D-256	ft.-lbs./in.	4	4		5	5	5	5	5	5
		J/mm	0.2	0.2		0.26	0.26	0.26	0.26	0.26	0.26

	ASTM Test Method	Units	Polyester PROForms	Vinylester PROForms	Rod & Bar PROForms	Polyester Flat Sheet			Vinylester Flat Sheet		
						1/8"	3/16" – 1/4"	3/8" – 1"	1/8"	3/16" – 1/4"	3/8" – 1"
PHYSICAL PROPERTIES											
Barcol Hardness	D-2583	–	45	45	50	40	40	40	40	40	40
24-Hour Water Absorption	D-570	% max., by wt.	0.60	0.60	0.25	0.60	0.60	0.60	0.60	0.60	0.60
Density	D-792	lbs./in.^{3}	.062-.070	.062-.070	.072-.076	0.60-0.68	0.60-0.68	0.60-0.68	0.60-0.68	0.60-0.68	0.60-0.68
		10^{-3}g/mm^3	1.72-1.94	1.72-1.94	1.99-2.10	1.66-1.88	1.66-1.88	1.66-1.88	1.66-1.88	1.66-1.88	1.66-1.88
Coefficient of Thermal Expansion (Typical), LW	D-696	10^{-6} in./in./°F	7.0	7.0	5.0	8.0	8.0	8.0	8.0	8.0	8.0
		10^{-6}mm/mm/°C	12.6	12.6	5.45	14.5	14.5	14.5	14.5	14.5	14.5
Thermal Conductivity	C-177	BTU/sf/hr/°F/in.	4	4	4	4	4	4	4	4	4
		W-m/m^2/ °C	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
ELECTRICAL PROPERTIES (based on polyester and vinylester resin systems)											
Arc Resistance, LW	D-495	seconds	120								
Dielectric Strength, LW	D-149	kv/in.	35								
Dielectric Strength, PF	D-149	volts/mil.	200								
Dielectric Strength, PF	D-150	@60hz	5								
FLAMMABILITY PROPERTIES (based on fire retardant polyester and fire retardant vinylester resin systems)											
Flammability Classification (1/8")	UL 94	V-0									
Tunnel Test	E-84	25 max.									
NBS Smoke Chamber E-662	E-662	600-700									
Flammability	D-635	Self Extinguishing									

LW=Lengthwise CW=Crosswise PF=Perpendicular to Laminate Face



Typical Properties of Threaded Rod and Nuts

Our threaded rod and nuts are manufactured using premium vinylester resin containing UV inhibitors. The properties shown are the result of the ASTM test method indicated.

Properties	ASTM Test Method	Units	Value Diameter – Threads per inch (UNC) 3/8" – 16	1/2" – 13	5/8" – 11	3/4" – 10	1" – 8
Ultimate Transverse Shear (Double Shear)	B-565	lb.	4,200	6,800	10,000	13,400	24,000
		N	18,683	30,248	44,482	59,606	106,757
Longitudinal Compressive Strength	D-695	psi	50,000	50,000	50,000	50,000	50,000
		MPa	345	345	345	345	345
Flexural Strength	D-790	psi	70,000	70,000	70,000	70,000	70,000
		MPa	483	483	483	483	483
	D-790	psi x 10^6	2.5	2.5	2.5	2.5	2.5
		GPa	17.2	17.2	17.2	17.2	17.2
Flammability	D-635		Self-extinguishing				
Fire Retardant	E-84		Class 1				
Water Absorption (24 Hour Immersion)	D-570	% max.	0.8	0.8	0.8	0.8	0.8
Longitudinal Coefficient of Thermal Expansion	D-696	10^{-6} in./in./°F	6	6	6	6	6
		10^{-6} mm/mm/°C	11	11	11	11	11
Ultimate Thread Shear (Using Fiberglass Nut)	–	lb.	1,200	2,400	3,600	4,000	8,200
		N	5,338	10,676	16,014	17,793	36,475
Ultimate Torque Strength (Fiberglass Nut Lubricated with SAE 10W30 Motor Oil)	–	ft.-lb.	8	16	35	50	110
		N-m	11	22	47	68	149
Rod Weight	–	lb./ft.	0.09	0.15	0.24	0.34	0.52
		g/m	40.82	68.03	108.86	154.22	235.86
Nut Weight	–	lb.	0.02	0.03	0.04	0.07	0.13
		grams	9.07	13.60	18.14	31.75	58.96
Nut Dimensions (Hex Nut Height)	–	in.	0.75	0.875	1.25	1.5	1.75
		mm	19.1	22.2	31.8	38.1	44.5
Color		Gray					

Fabricating With FRP

PROForms® structural shapes are designed to provide superior mechanical properties and corrosion resistance. These products, combined with our PROGrid® and PROGrate® grating, are often used to fabricate structures such as stair/handrail assemblies, ladders, walkways and more. Our manufacturing headquarters includes a state-of-the-art fabrication facility, so we can cut, drill and assemble profiles to your specs or ship them ready to assemble in the field.

Fastening

There are many ways to fasten FRP to FRP or FRP to other materials, including riveted, screwed, and bolt-and-nut connections. Bolts and threaded holes are also possible (bonding in place is recommended), as well as lag screws when fastening profiles to wood.

Adhesives

Adhesives can also provide a very strong bond between two FRP shapes or between FRP and other structural materials. For best results, the mating surfaces must be properly prepared, and the recommended type of adhesive must be used. Adhesive should also be applied in a controlled environment, as air temperature and humidity can adversely affect the cure.

FRP Preparation

Almost all fabrication methods currently used for wood, aluminum and steel are available for the fabrication of our FRP building materials. PROForms products can be sawed, drilled, routed, punched and turned using standard metalworking equipment.

Shearing is only recommended on material 3/16" or thinner. Diamond-coated or carbide saw blades and bits are recommended, as well as properly sharpened tools for faster speeds and less wear on tools.

Cutting Tips

When performing any cutting operation, use light, evenly applied pressure. Excessive pressure tends to clog the blade with dust particles, and this will shorten the life of the blade. Cutting speed is very important. Cutting too fast will fray the edge of the material and may cause it to turn black.

Visit **bedfordreinforced.com** and download the Fabrication Manual for more details on general fabrication guidelines.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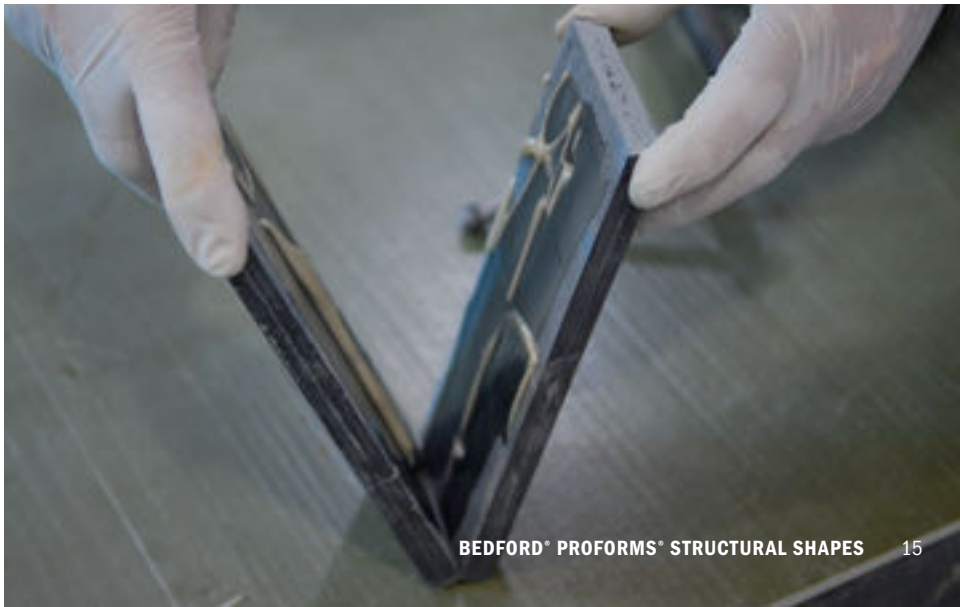

EXPLORE OUR FULL LINE OF FRP SOLUTIONS

Bedford offers a wide variety of structural products made of fiberglass-reinforced polymer, including PROForms® shapes, PROGrid® molded grating and PROGrate® pultruded grating. Our staff of skilled engineering, design and manufacturing professionals is dedicated to helping our customers maximize the benefits of FRP.

PRODUCTS

- Structural shapes
- Grating
- Decking
- Stairs and handrails
- Ladders and cages
- Fabricated structures

SERVICES

- Design and drafting
- Engineering
- Fabrication and CNC machining
- Secondary coating and painting
- Assembly and kitting
- In-house testing

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When you receive a ready-to-ship date from Bedford, it's GUARANTEED*. If we miss the promised ship date, we pay significant penalties back to you. We also offer Express Response options with shorter, guaranteed lead times.

LIMITED 25 YEARS WARRANTY

Bedford PROForms® products are warranted against manufacturing defects for 25 years*, so you can specify our FRP building material with confidence.

* Terms and conditions apply. Download our complete guarantee and warranty at **bedfordreinforced.com** or contact us for details. Ship date guarantees available in most areas.

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