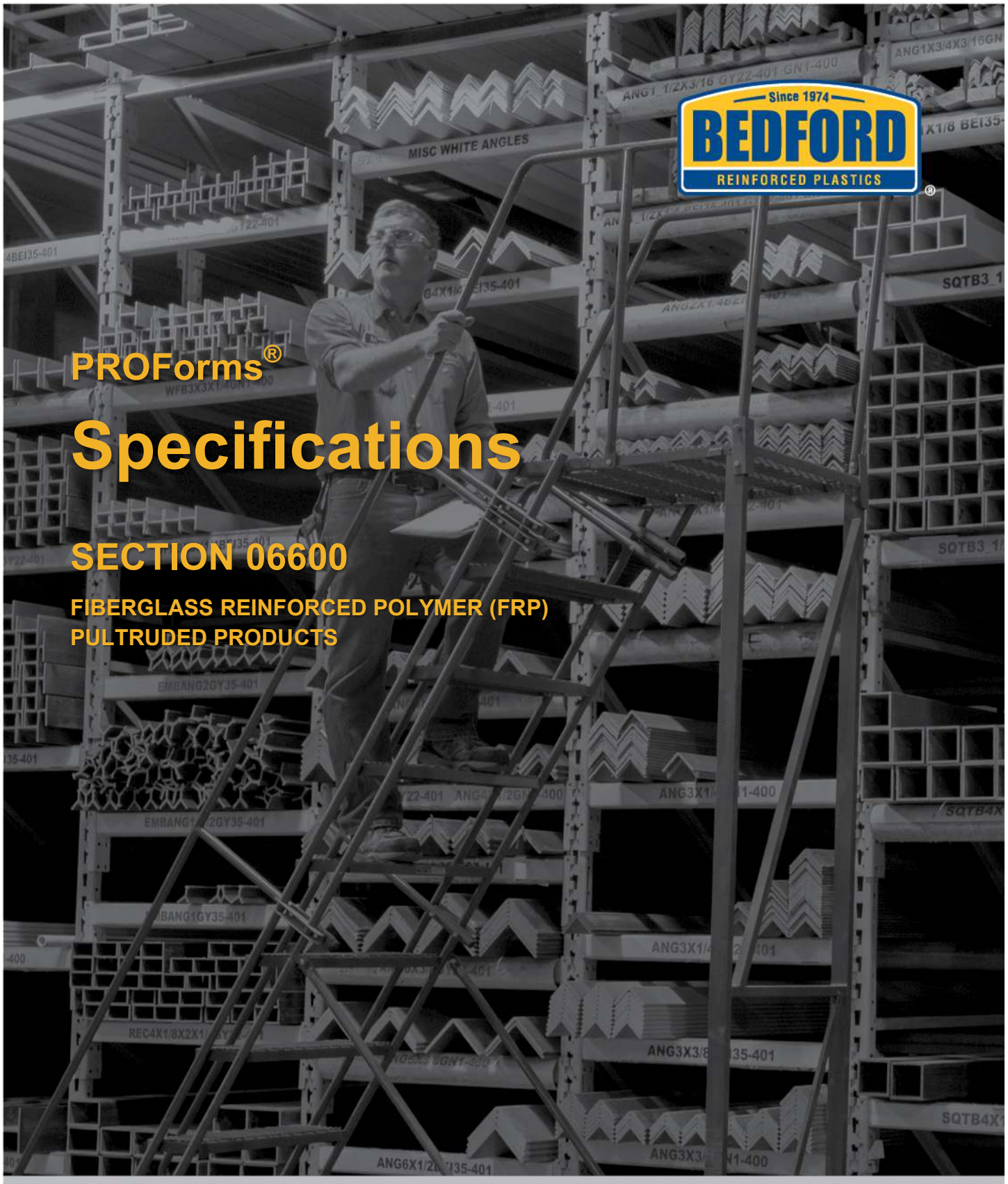

PROForms®

Specifications

SECTION 06600

FIBERGLASS REINFORCED POLYMER (FRP) PULTRUDED PRODUCTS

BEDFORD PROForms® MADE IN THE U.S.A.

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SECTION 06600

FIBERGLASS REINFORCED POLYMER (FRP) PULTRUDED PRODUCTS

PART 1: GENERAL

1. SCOPE OF WORK

   A. The contractor shall provide all labor, materials, equipment and incidentals as specified and are required to furnish and install FRP pultruded products.

2. QUALITY ASSURANCE

   A. Manufacturer and Fabrication Qualifications: Manufacturer and fabricator shall have a minimum of ten (10) years of proven successful experience supplying and fabricating FRP pultruded products with sufficient capacity to meet the project schedule requirements.
   B. Contractor shall comply with provisions and recommendations of applicable standards and manufacturer's instructions and recommendations for work.
   C. Substitution of materials shall not be accepted unless they are submitted for review and the Architect/Engineer approves their use.

3. DESIGN CRITERIA

   A. The design of PROForms® pultruded structural profiles, including connections, shall be in accordance with governing building codes and standards as applicable.
   B. All pultruded structural members shall be designed to support all applied loads with a maximum deflection of L/180 unless stated otherwise in drawings.
   C. Temperature exposure is limited to 100°F (38°C) unless specifically stated otherwise in drawings and/or supplementary conditions.
   D. Any chemical exposure shall be discussed with the manufacturer and selection of resin series of the pultruded products shall be based on manufacturer's compliance report.

4. SUBMITTALS

   A. The contractor shall submit to the owner or its representative, for approval, shop drawings for fabrication and erection of the work. Included shall be plans, elevations, sections and details of the work.
   B. The contractor shall submit the manufacturer's product data sheet including specifications, load tables, anchor details and standard installation details.
   C. Fabrication shall not start until the formal receipt of final approval of the shop drawings from the EOR or registered design professional.

5. SHIPPING AND STORAGE INSTRUCTIONS

A. All the pultruded sections shall be shop fabricated and assembled into the largest practical size suitable for transporting.
B. All materials and equipment necessary for the fabrication and installation of pultruded structures and accessories shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun.
C. Any material which, in the opinion of the design engineer, has become damaged as to be unfit for use shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.
D. Identify and match-mark all materials, items and fabrications for installation and field assembly.

PART 2: PRODUCT

1. GENERAL

   A. All the products shall be manufactured by Pultrusion process and use approved raw materials. The manufacturer shall submit a certificate of compliance upon the request of EOR. All the pultruded products shall be manufactured in United States of America.

2. MATERIAL

   A. All the pultruded products shall be made of either Isopthalic Polyester or Vinylester resin. The resin may contain fillers and additives such as flame retardants, UV light absorbers, pigments etc. as needed.
   B. All the pultruded parts shall have a minimum of 50% glass and all the glass reinforcements shall be made of either E-glass or superior continuous glass rovings and/or continuous strand mats.
   C. Unless specified, all the parts shall have a minimum of 10 mil thick synthetic polyester surface veil on the outer surface of the pultruded part
   D. All the pultruded parts shall be in conformance with latest ASTM D 4385 for "Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products" and latest ASTM D 3917 for “Standard Specification for Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes”
   E. The mechanical, physical, fire and electrical properties shall meet or exceed the values given in Table 1.
   F. The raw materials used in the manufacturing of the pultruded products shall be free of lead and conflict minerals
   G. Manufacturers

      1. Bedford Reinforced Plastics Inc.

   H. Pultruded FRP products shall be manufactured and fabricated in the USA. Manufacturer shall provide a written Certificate of Compliance.

TABLE 1

	ASTM TEST METHOD	UNITS	POLY-ESTER SHAPES	VINYL-ESTER SHAPES	ROD & BAR	POLYESTER PLATE			VINYLESTER PLATE		
						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/mm²	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/mm²	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/mm²	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/mm²	5.5	5.5		4.8	6.2	9.6	6.9	6.9	9.6
Compressive Stress, LW	D-695	psi	30,000	30,000	60,000	24,000	24,000	24,000	24,000	24,000	24,000
		N/mm²	206.8	206.8	413.6	165.4	165.4	165.4	165.4	165.4	165.4
Compressive Stress, CW	D-695	psi	15,000	16,000		15,500	16,500	20,000	16,500	17,500	20,000
		N/mm²	103.4	110.3		106.8	113.7	137.9	113.79	120.6	137.9
Compressive Modulus, LW	D-695	10^6 psi	2.5	2.6		1.8	1.8	1.8	1.8	1.8	1.8
		KN/mm²	17.2	17.9		12.4	12.4	12.4	12.4	12.4	12.4
Compressive Modulus, CW	D-695	10^6 psi	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
		KN/mm²	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/mm²	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/mm²	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/mm²	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/mm²	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/mm²	17.9	19.3							
Modulus of Elasticity, E (W & I Shapes > 4")	Full Section	10^6 psi	2.5	2.5							
		KN/mm²	17.2	17.2							
Shear Modulus, LW	Full Section	10^6 psi	0.425	0.425							
		KN/mm²	2.9	2.9							
Short Beam Shear, LW	D-2344	psi	4,500	4,500	8,000						
		N/mm²	31.0	31.0	55.2						
Ultimate Bearing Stress, LW & CW	D-953	psi	30,000	30,000		32,000	32,000	32,000	32,000	32,000	32,000
		N/mm²	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	1.28	1.28	2.04	0.94	1.02	1.02	0.94	1.02	1.02
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

TABLE 1 (Continued)

	ASTM TEST METHOD	UNITS	POLY-ESTER SHAPES	VINYL-ESTER SHAPES	ROD & BAR	POLYESTER PLATE			VINYLESTER PLATE		
						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	V0									
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

PART 3: EXECUTION

A. All required fabrication shall be performed in the manufacturer's shop in accordance with the approved shop drawings.
B. The pultruded structural parts shall be received at the job site by the contractor, unloaded and protected from damage prior to the requirement for it to be installed.
C. The installing contractor shall prepare the site for installation including the anchoring system (as applicable), and ensure any deviations from the approved shop drawings by the EOR are corrected prior to installing the components.

END OF SECTION