H.B. Composites

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Series 1500 Fiberglass

Pipe and Fittings (GRP)

Engineered for moderate-pressure and severely corrosive industrial service with a corrosion-resistant vinyl ester liner and isophthalic polyester resin-based structural body.

Uses and Applications

- **Key Applications**: Chemical processing (transfer of acids, alkalis, and solvents), bleach processing, chlorinated processes, phosphoric acid handling, desalination (chlorination systems and brine handling), water treatment (potable water and wastewater in corrosive environments), petrochemical (handling of corrosive fluids and slurries), industrial piping (process piping for aggressive chemical media), general industrial service for severely corrosive liquids, waste management (acid drains), food industry (food processing plant, meets USFDA requirements), chemical variants (organic chemicals, overture chemicals and acids).
- **Application Conditions**: Pressure range 2–16 bar (29–232 psi), depending on diameter and variant; temperature range -40°C to 75°C (-40°F to 167°F) for GRP with vinyl ester resin; fluid compatibility suitable for aggressive chemicals, acids, alkalis, and potable water (pH 1–13). Consult H.B. Composites' Corrosion Guide (FP 132) for specific compatibility.
- **Case Studies**: Bandar Abbas Desalination Plant (Iran): Series 1500 GRV used for chlorination systems, installed for Kaysoun Water and Environment Co., operational since 1401 (2022).

Listings

- **Standards and Certifications**: Designed and manufactured in accordance with the following standards and specifications: ASTM D3517, ASTM D2992 (Procedure B, service factor 0.5), ASTM D1599, ASTM D2996, ASTM D2310 (Type I, Grade 2, Class E), ISO 14692, AWWA C950, AWWA Manual M45-3, NSF/ANSI 61 for potable water systems.

• Complies with USFDA requirements for food contact applications under 21 CFR 175.105 and 21 CFR 177.2420, when assembled using RP-105B vinyl ester adhesive.

Performance

Parameter	Value	Test Method
Max Pressure[1]	16 bar	ASTM D3517
Surge Pressure	24 bar	ASTM D3517
Flow Coefficient[2]	C=150	Hazen-Williams
Service Life	20+ years	ASTM D2992
Impact Energy	18 J	ASTM D2444
Corrosion Resistance[3]	pH 0–14	Corrosion Guide
Thermal Conductivity[4]	Low	-

[1] Designed for moderate-pressure applications with a working pressure range of 29.0 to 232.1 psig (0.2 to 1.6 MPa), depending on pipe size, offering excellent resistance to thermal stress and corrosion, suitable for long-term industrial use. Individual system components may not have the same ratings as the pipe. Refer to detailed product information for the specific components to determine the pressure rating for the system as a whole.

[2] Smooth inner liner (Hazen-Williams C=150) produces extremely low frictional loss for greater discharge and reduced pumping costs.

[3] Integrates a vinyl ester liner and fiberglass body with an Isophthalic Acid Polyester resin system, ensuring robust weathering resistance and reliable protection in moderately acidic conditions up to 175°F (79°C). Subzero temperatures will not adversely affect mechanical properties. Refer to the H.B. Composites Corrosion Guide for specific applications.

[4] Low thermal conductivity minimizes heat losses. Does not require thrust blocks at ambient temperatures when properly installed in most soils.

Composition

Component	Material	Weight %	Function
Resin	**Vinyl Ester** (Liner)	75–80	Corrosion resistance

	Isophthalic Polyester (Structure)	25–30	Structural integrity
Fibers	**C-Veil** (Liner)	20–25	Chemical barrier
	E-Glass (Structure)	65–70	Tensile strength
Top Coat	Paraffin-modified Polyester	<1	UV protection, surface finish

- Includes a trace additive to facilitate curing process.
- Manufactured via filament winding (ASTM D2996, RTRP-12ED, 2–36 inch) with fibers at 54.7° for balanced strength, using vinyl ester for the 1. 3 mm resin-rich liner and isophthalic polyester for the structural shell.
- Includes filament-wound (tees, elbows, crosses, laterals, reducers) and molded fittings (tees, elbows 2–6 inch, flanges per ANSI B16.1/5), with RP105B vinyl ester and RP34C GRP adhesives.

Joining System

Joint Type	Pressure Rating	Installation Time	Applications
Tapered Socket (M-F)	2–16 bar	12 min	Industrial, desalination
Flanged	2–16 bar	15 min	Petrochemical
Lamination	2–16 bar	30 min	Chemical, desalination

- Joints require a curing time of 2–4 hours at 25°C for optimal strength and integrity. 17

Pipe Lengths

Nominal Pipe Size		**Random Lengths**	
(in)	(mm)	(ft)	(m)
0.5 - 6	12.7 - 152.4	30	9
8 - 80	203.2 - 2032	20	12
Custom Length		Up to 15 m, ±25 mm	

- **Available Fittings and Specifications**: Elbows, tees, flanges (including blind flanges and reducing flanges), plugs and end-caps, crosses, nipples and couplings, 45° laterals, and tapered body reducers. Tapered Socket (M-F) and filament-wound or molded flange ends available. Laying lengths match ANSI

B16.9 steel buttwelding fittings; flanged ends conform to ANSI B16.1 and B16.5 center-to-face and face-to-face dimensions.

Typical Pipe Dimensions and Weights

Typical Pipe Dimensions and Weights of Series 1500(GRP) at 16 bar

Nominal Pipe Size[1]		Pipe ID		Nominal Wall Thickness[2]		Average Sectional Area[3]		Pipe Weight[4]	
NPS (in)	DN (mm)	(in)	(mm)	(mm)	(in)	(mm²)	(in²)	(kg/m)	(lb/ft)
½	15	0.6	15	5.6	0.3	362.5	0.6	2	1.4
¾	20	0.8	20	5.6	0.3	450.4	0.7	2	1.4
1	25	1.1	27	5.6	0.3	573.6	0.9	2	1.4
1½	40	1.7	42	5.6	0.3	837.5	1.3	2	1.4
2	50	2.1	53.2	5.6	0.3	1031	1.6	4	2.7
2½	65	2.6	65	5.6	0.3	1242.1	2	4	2.7
3	80	3.3	82	5.6	0.3	1541.2	2.4	4	2.7
4	100	4.2	105	7.3	0.3	2575.5	4	6	4.1
6	150	6.3	159	7.3	0.3	3813.9	6	8	5.4
8	200	8.3	209	8	0.4	5453.9	8.5	12	8.1
10	250	10.4	263	8	0.4	6811	10.6	14	9.5
12	300	12.4	314	9	0.4	9132.7	14.2	20	13.5
14	350	13.6	344	9.8	0.4	10892.7	16.9	22	14.8
16	400	15.6	394	11	0.5	13995.8	21.7	28	18.9
18	450	17.1	434	12	0.5	16813.9	26.1	34	22.9
20	500	19	482	13.2	0.6	20535.5	31.9	42	28.3
24	600	22.8	579	15.5	0.7	28949	44.9	58	39
28	700	27.6	700	18.5	0.8	41758.9	64.8	84	56.5
30	750	29.6	750	19.7	0.8	47636.3	73.9	96	64.6
32	800	31.5	800	20.9	0.9	53899.8	83.6	108	72.6
36	900	35.5	900	23.4	1	67882.2	105.3	136	91.4
40	1000	39.4	1000	25.8	1.1	83144.3	128.9	168	112.9
42	1050	41.4	1050	27.1	1.1	91701.3	142.2	184	123.7
48	1200	47.3	1200	30.7	1.3	118697.2	184	238	160
52	1300	51.2	1300	33.2	1.4	139054	215.6	280	188.2
54	1350	53.2	1350	34.4	1.4	149613.2	232	300	201.6
56	1400	55.2	1400	35.6	1.5	160558.6	248.9	322	216.4
60	1500	59.1	1500	38.1	1.5	184102.4	285.4	370	248.7
64	1600	63	1600	40.5	1.6	208728.3	323.6	418	280.9
68	1700	67	1700	43	1.7	235459.3	365	472	317.2
72	1800	70.9	1800	45.4	1.8	263206.3	408	528	354.8
80	2000	78.8	2000	50.3	2	323992.8	502.2	648	435.5

Typical Pipe Dimensions and Weights of Series 1500(GRP) at 10 bar

Nominal Pipe Size[1]		Pipe ID		Nominal Wall Thickness[2]		Average Sectional Area[3]		Pipe Weight[4]	
NPS (in)	DN (mm)	(in)	(mm)	(mm)	(in)	(mm^2)	(in^2)	(kg/m)	(lb/ft)
½	15	0.6	15	5.6	0.3	362.5	0.6	2	1.4
¾	20	0.8	20	5.6	0.3	450.4	0.7	2	1.4
1	25	1.1	27	5.6	0.3	573.6	0.9	2	1.4
1½	40	1.7	42	5.6	0.3	837.5	1.3	2	1.4
2	50	2.1	53.2	5.6	0.3	1031	1.6	4	2.7
2½	65	2.6	65	5.6	0.3	1242.1	2	4	2.7
3	80	3.3	82	5.6	0.3	1541.2	2.4	4	2.7
4	100	4.2	105	5.6	0.3	1945.8	3.1	4	2.7
6	150	6.3	159	5.6	0.3	2895.8	4.5	6	4.1
8	200	8.3	209	5.6	0.3	3775.5	5.9	8	5.4
10	250	10.4	263	6.1	0.3	5157	8	12	8.1
12	300	12.4	314	7.1	0.3	7162.3	11.2	16	10.8
14	350	13.6	344	7.6	0.3	8394.9	13.1	18	12.1
16	400	15.6	394	8.5	0.4	10748.2	16.7	22	14.8
18	450	17.1	434	9.2	0.4	12809.7	19.9	26	17.5
20	500	19	482	10.1	0.4	15614.4	24.3	32	21.6
24	600	22.8	579	11.9	0.5	22090.8	34.3	46	31
28	700	27.6	700	14.1	0.6	31632.1	49.1	64	43.1
30	750	29.6	750	15 .0	0.6	36049.8	55.9	74	49.8
32	800	31.5	800	15.9	0.7	40755.3	63.2	82	55.2
36	900	35.5	900	17.7	0.7	51029.9	79.1	104	69.9
40	1000	39.4	1000	19.5	0.8	62455.7	96.9	126	84.7
42	1050	41.4	1050	20.4	0.9	68600.4	106.4	138	92.8
48	1200	47.3	1200	23.2	1	89152.9	138.2	180	121
52	1300	51.2	1300	25.0	1	104065.3	161.4	210	141.2
54	1350	53.2	1350	25.9	1.1	111953.2	173.6	224	150.6
56	1400	55.2	1400	26.8	1.1	120129	186.3	242	162.7
60	1500	59.1	1500	28.6	1.2	137344.1	212.9	276	185.5
64	1600	63	1600	30.4	1.2	155710.5	241.4	312	209.7
68	1700	67	1700	32.3	1.3	175782.5	272.5	352	236.6
72	1800	70.9	1800	34.1	1.4	196484.1	304.6	394	264.8
80	2000	78.8	2000	37.7	1.5	241341.3	374.1	484	325.3

[1] For availability of ½, ¾, 1, 1½, 2½ inches and sizes above 14 inches (350 mm), consult your H.B. Composites representative.

[2] Includes an additional 1.3 mm liner. Determined based on standard pressure rating calculations (up to 16 bar / 232 psi), with wall thickness varying by diameter and stiffness

class. Minimum wall thickness shall not be less than 87.5% of the nominal value in accordance with ASTM D2996.

[3] Use provided values for calculating longitudinal thrust forces and structural design.

[4] Reported weights are approximately 10–15% higher than theoretical due to composite composition (65–70% E-glass fiber by weight).

Typical Physical Properties

Pipe Property[1]	Units	Vinyl Ester	Isophthalic
Thermal Conductivity	Pipe wall Btu·in/(hr·ft^2·°F)	2.0	2.0
	W/m·°C	0.29	0.29
Thermal Expansion	Linear 10^{-6} in/in/°F	10	14
	10^{-6} mm/mm/°C	18	25
Flow Coefficient	Hazen-Williams' 'C'	150	150
	Manning's 'n'	0.009	0.009
Absolute Roughness	10^{-6} ft	17.5	17.5
	10^{-6} m	5.3	5.3
Specific Gravity	-	1.8	2.0
Density	lb/in^3	0.065	0.072

[1] At 85°F

Typical Mechanical Properties

Pipe Property[1]	Units	Vinyl Ester	Isophthalic
Circumferential Tensile Stress	10^3 psi	20.0	20.0
	MPa	138.0	138.0
Tensile Modulus	10^6 psi	3.13	3.20
	GPa	21.6	22.1
Longitudinal Tensile Strength	10^3 psi	7.0	6.9
	MPa	48.3	47.6
Tensile Modulus	10^6 psi	1.3	1.3
	GPa	9.0	9.0
Beam Apparent Elastic Modulus	10^6 psi	1.40	1.6
	GPa	9.7	10.7

[1] At 70°F (21°C)

Field Testing

Test Type	Pressure	Standard	Description
Hydrostatic	1.5 x Rated Pressure	AWWA C950	Verifies structural integrity under high pressure.
Leak	1.1 x Operating Pressure	AWWA C950	Confirms no leakage under operational conditions.

- *Pneumatic testing* is not recommended.

Pipe Construction

- **Inner Liner**: A reinforced resin-rich liner with a nominal thickness of 50 mil (1.3 mm), composed of 75–80% vinyl ester resin and 20–25% C-veil.
- **Structural Wall**: Continuous E-glass fibers wound at a 54¾° helical angle, comprising 65–70% E-glass fibers and 25–30% isophthalic acid polyester resin.
- **Top Coat**: A paraffin-modified isophthalic polyester resin applied for UV protection.
- **Pressure Rating**: 500 psig (0.5-in) to 175 psig (16-in) at 70°F, down to 125 psig (20-in) and 50 psig (30-in), ~76% at 168°F per AWWA M45-3; consult H.B. Composites for >30-in sizes.
- **Vacuum Capability**: Full vacuum capability at 70°F for 2–8 inch sizes when installed above ground, with a 3:1 safety factor, due to reduced structural resistance in larger diameters (consult H.B. Composites for sizes above 8 inches).
- **Manufacturing Standard**: Complies with ASTM D2996 for filament-wound Reinforced Thermosetting Resin Pipe (RTRP), classified as Type 1, Grade 2, Class E (RTRP-12ED) for 2–16 inch sizes per ASTM D2310.
- **Color**: Filament-wound Series 1500 GRP pipe shall be gray.
- **Length**: Furnished in random lengths of 30 ft (9 m) for 0.5 to 6-inch sizes and 20 ft (12 m) for 8 to 80-inch sizes, with custom lengths available up to 15 m (±25 mm) upon request.

Standard Fitting Construction

• **Fittings**: Filament-wound with a reinforced resin-rich liner of equal or greater thickness than the pipe liner (minimum 50 mil or 1.3 mm), comprising 75–80% vinyl ester resin and 20–25% C-veil, and a reinforced section with 65–70% E-glass fibers and 25–30% isophthalic polyester resin.

• **Compression-Molded Fittings**: Permitted for 2, 3, 4, and 6-inch sizes upon agreement between purchaser and manufacturer.

• **Prohibited Methods**: Contact-molded, spray-up, or hand-layup fittings are not allowed.

• **Joining Method**: Pipe and fittings shall be joined using a straight spigot-by-socket system with a 0.5° taper angle and an internal pipe stop in the socket.

Workmanship

• The H.B. Composites Series 1500 GRP pipe and fittings shall be free from all defects, including delaminations, indentations, pinholes, foreign inclusions, bubbles, and resin-starved areas, which, due to their nature, degree, or extent, detrimentally affect the strength and serviceability of the pipe or fittings. The pipe and fittings shall be as uniform as commercially practicable in color, density, and other physical properties.

Testing

• Samples of Series 1500 (GRP) pipe and couplings shall undergo rigorous random testing based on standard quality control practices to verify compliance with ASTM guidelines for fiberglass pipe products. Specific tests include:

○ **ASTM D1599**: Hydrostatic testing at 1.5 times the pressure rating to check for leakage.

○ **ASTM D2105**: Evaluation of tensile properties to ensure mechanical strength.

○ **ASTM D2925**: Assessment of elastic modulus under varying conditions.

○ **ASTM D2992A** or **D2992B**: Determination of long-term hydrostatic design basis, confirming a service life of 20+ years.

Conversions

- For ease of use and international compatibility, the following unit conversions are provided, consistent with standards:
    - 1 psi = 6895 Pa = 0.07031 kg/cm²
    - 1 bar = 10^5 Pa = 14.5 psi = 1.02 kg/cm²
    - 1 MPa = 10^6 Pa = 145 psi = 10.2 kg/cm²
    - 1 GPa = 10^9 Pa = 145,000 psi = 10,200 kg/cm²
    - 1 in = 25.4 mm
    - 1 ft = 0.3048 m
    - 1 lb·in = 0.113 N·m
    - 1 in^4 = 4.162 × 10^{-7} m^4
    - °C = 5/9 (°F - 32)

Important Notices

- The information in this catalog is based on data from H.B. Composites, industry standards, and test results believed to be reliable. However, H.B. Composites does not warrant the suitability of the Series 1500 GRP for specific applications; users must verify compatibility and consult H.B. Composites for project-specific details.

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