

Bondstrand™ Series 3000 Fiberglass Pipe for General Industrial Service

Uses and Applications

- Boiler feed water
- Bridge, roof and floor drains
- Brine and brackish water
- Chemical process piping
- Cooling water
- Demineralized water
- Electroplating
- Fuel oil piping
- General service piping
- Mild chemicals
- Municipal waste
- Oilfield gathering, transmission lines
- Power plant, steel mill and industrial plant piping
- Sewer lines and sewer force mains
- Source and recycle water
- Sump discharge
- Vent lines
- Water mains
- Water treatment

Performance

Working pressure to 450 psig depending on pipe size.

Operating surge pressure to 1.25 times rated operating pressure.

No thrust blocks are required at rated system pressure for most buried piping configurations and most soil conditions.

Temperatures to 150°F (66°C) maximum.

Full vacuum capabilities when buried and properly backfilled. For above ground use, refer to collapse pressures listed below under pipe pressure performance.

Recommended burial depth: 3 to 25 feet.

Recommended for water, waste water (pH 1 to 8.5), moderately corrosive liquids and mild chemicals. Consult corrosion guide or Applications Engineering for recommendations for your particular application.

Individual system components may not have the same ratings as the pipe. Refer to the detailed product information for the specific components to determine the pressure rating for the system as a whole.

Composition

Pipe

Filament-wound fiberglass reinforced epoxy pipe with integral epoxy liner and exterior coating.

Pipe Size		ASTM Designation	
in	mm	D2310	D2996
2 - 6	50 - 150	RTRP 11FX	RTRP 11FX-5420
8 - 16	200 - 400	RTRP 11FW	RTRP 11FW1-3210

Fittings

2 to 6 inch

Compression-molded fiberglass reinforced epoxy elbows and tees
Filament-wound and/or mitered crosses, wyes, laterals and reducers

8 to 16 inch

Filament-wound fiberglass reinforced epoxy elbows
Filament-wound and/or mitered crosses, wyes, and laterals
Contact-molded reducers

Flanges

Flange rings:

Molded or filament-wound fiberglass

Stub ends:

Molded or centrifugally cast fiberglass

Blind flanges

Compression-molded fiberglass or epoxy-coated cast iron or steel.

Adhesive

Two-part epoxy adhesive for field fabrication. (Consult NOV Fiber Glass Systems for specifications.)

Joining Systems

2 to 16 inch

Bell and spigot taper/taper adhesive-bonded joint.

Pipe Lengths

Standard 20 and 39 ft. random lengths.

Other lengths available on request.

Typical Pipe Dimensions and Weights

Nominal Pipe Size		Outside Diameter ⁽¹⁾		Inside Diameter		Wall Thickness			
						Total		Structural	
in	mm	in	mm	in	mm	in	mm	in	mm
2	50	2.38	60	2.22	56	0.080	2.9	0.069	1.7
3	80	3.50	89	3.33	85	0.085	2.1	0.074	1.9
4	100	4.51	115	4.34	110	0.087	2.2	0.077	1.9
6	150	6.64	169	6.40	163	0.120	3.0	0.114	2.9
8	200	8.60	218	8.30	211	0.150	3.8	0.113	2.9
10	250	10.77	274	10.42	265	0.175	4.4	0.141	3.6
12	300	12.70	323	12.30	312	0.200	5.1	0.170	4.3
14	350	14.44	367	14.01	356	0.215	5.5	0.187	4.8
16	400	16.50	419	16.03	407	0.235	6.0	0.210	5.3

⁽¹⁾ Typical outside diameters of 2 through 12 inch pipe are within API, ASTM and ANSI fiberglass and steel pipe dimensions.

Nominal Pipe Size		Taper Angle	Taper Length		Pipe Weight	
			in	mm	lb/ft	kg/m
in	mm	deg	in	mm	lb/ft	kg/m
2	50	1.75	1.5	38	0.5	0.75
3	80	1.75	1.7	43	0.7	1.05
4	100	1.75	1.9	48	1.0	1.50
6	150	1.75	2.8	71	1.9	2.85
8	200	2.00	2.6	66	3.1	4.60
10	250	2.00	3.1	79	4.5	6.70
12	300	2.00	3.6	91	6.1	9.10
14	350	2.00	4.2	107	7.5	11.15
16	400	2.00	4.7	119	9.4	14.00

Typical Pipe Performance

Nominal Pipe Size		Static Pressure Rating at 150°F		Ultimate Internal Pressure ⁽¹⁾		Ultimate Collapse Pressure ⁽²⁾			
						80°F	27°C	150°F	99°C
in	mm	psig	bar	psig	bar	psig	bar	psig	bar
2	50	450	31	3,200	221	145	10.0	125	8.6
3	80	400	28	2,400	166	50	3.4	45	3.1
4	100	325	22	2,000	138	40	2.8	35	2.4
6	150	300	20	2,000	138	35	2.4	30	2.1
8	200	150	10	900	62	25	1.7	21	1.4
10	250	150	10	900	62	18	1.2	12	0.8
12	300	150	10	900	62	12	0.8	9	0.6
14	350	150	10	900	62	10	0.7	7.5	0.5
16	400	150	10	900	62	10	0.7	7.5	0.5

⁽¹⁾ Quality Control minimum

⁽²⁾ For vacuum service above ground in sizes 10 inches and above consult NOV Fiber Glass Systems.

Fittings Pressure Ratings⁽³⁾									
Nominal Pipe Size		Elbows ⁽¹⁾		Tees		Flanges ⁽²⁾		Blind Flanges	
in	mm	psig	bar	psig	bar	psig	bar	psig	bar
2	50	450	31	350	24	450	31	450	31
3	80	400	28	300	21	400	28	400	28
4	100	325	22	225	16	325	22	325	22
6	150	300	21	200	14	300	21	300	21
8	200	150	10	150	10	150	10	150	10
10	250	150	10	150	10	150	10	150	10
12	300	150	10	150	10	150	10	150	10
14	350	150	10	150	10	150	10	150	10
16	400	150	10	150	10	150	10	150	10

Nominal Pipe Size		Adapters		Laterals, Wyes and Crosses		Saddles	
in	mm	psig	bar	psig	bar	psig	bar
2	50	450	30	200	13	300	20
3	80	375	25	200	13	300	20
4	100	300	20	200	13	200	13
6	150	300	20	200	13	150	10
8	200	150	10	150	10	150	10
10	250	—	—	150	10	100	8
12	300	—	—	150	10	75	5
14	350	—	—	150	10	50	3
16	400	—	—	150	10	50	3

⁽¹⁾ Ratings shown are for 90° and 45° elbows. Ratings in 8 to 16 inch sizes are also applicable to elbows of other angles.

⁽²⁾ ANSI B16.5 CL150 psig bolt hole pattern

⁽³⁾ Ratings at 150°F

Typical Physical Properties			
Pipe Property	Units	Value	ASTM
Thermal conductivity	Btu-in/(h•ft ² •°F) W/m•°C	1.7 0.25	C177
Coefficient of thermal expansion (linear) (77°F to 210°F) (25°C to 65°C)	10 ⁻⁶ in/in/°F 10 ⁻⁶ cm/cm/°C	8.5 to 12 15.3 to 21.6	D696 E228
Flow coefficient	Hazen-Williams	150.0	—
Absolute roughness	10 ⁻⁶ ft 10 ⁻⁶ m	50.0 15.0	—
Specific gravity	—	1.81	D792

Typical Mechanical Properties

Pipe Property ⁽¹⁾	Units	Value ⁽¹⁾		ASTM
		2 - 6 in	8 - 16 in	
Tensile strength Longitudinal	10 ³ psi	35.0	20.0	D2105
	MPa	240.0	138.0	
Circumferential	10 ³ psi	70.0	40.0	D1599
	MPa	480.0	275.0	
Tensile modulus Longitudinal	10 ⁶ psi	2.7	1.5	D2105
	GPa	18.6	10.3	
Circumferential	10 ⁶ psi	4.2	2.3	—
	GPa	29.0	15.9	
Compressive strength Longitudinal	10 ³ psi	35.0	20.0	—
	MPa	240.0	138.0	
Compressive modulus Longitudinal	10 ⁶ psi	2.7	1.5	—
	GPa	18.6	10.3	
Long-Term Hydrostatic Design Basis ⁽³⁾				
Static, Hoop Stress 95% LCL 20-year Life @150°F/65°C	10 ³ psi	18.9	18.9	D2992 Procedure B
	MPa	130.3	130.3	
Cyclic, Hoop Stress 95% LCL 20-year Life @75°F/24°C	10 ³ psi	6.4	—	D2992 Procedure A
	MPa	44.1	—	
Poisson's Ratio ⁽²⁾	—	0.17	0.17	—
	—	0.15	0.15	

(1) Based on structural wall thickness, at room temperature unless noted.

(2) The first subscript denotes the direction of applied stress and the second subscript the measured strain contraction.
x denotes longitudinal direction.
y denotes circumferential direction.

(3) Test fixtures were end type (full end thrust on samples).

Nominal Pipe Size		Change in Length Due to Pressure ⁽¹⁾		Stiffness Factor ⁽²⁾	
in	mm	in/100 ft/100 psi	mm/10m/10 bar	lb•in ³ /in ²	N•m
2	50	0.271	3.27	45	5.1
3	80	0.379	4.58	75	8.5
4	100	0.482	5.82	60	6.8
6	150	0.477	5.76	275	31.1
8	200	1.085	13.11	500	56.5
10	250	1.088	13.15	750	85.0
12	300	1.069	12.92	1,250	140.0
14	350	1.107	13.38	1,600	180.0
16	400	1.130	13.65	2,000	225.0

(1) In an unrestrained system due to pressure effects alone.

(2) At 5% deflection.

Support Spacing

(Values are based on a ½ inch (12 mm) deflection at mid span.)⁽⁴⁾

Nominal Pipe Size		Single Span ⁽¹⁾						Continuous Span ⁽²⁾					
		Gases		1.00 ⁽³⁾		1.3 ⁽³⁾		Gases		1.00		1.3 ⁽³⁾	
in	mm	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
2	50	13.9	4.2	9.9	3.0	9.4	2.9	16.5	5.0	11.8	3.6	11.2	3.4
3	80	17.5	5.3	11.2	3.4	10.6	3.2	20.8	6.3	13.3	4.1	12.6	3.8
4	100	19.5	6.0	12.1	3.7	11.4	3.5	23.2	7.1	14.3	4.4	13.6	4.1
6	150	24.2	7.4	14.4	4.4	13.7	4.2	28.8	8.8	17.2	5.2	16.3	5.0
8	200	23.1	7.0	13.6	4.1	12.8	3.9	27.5	8.4	16.2	4.9	15.2	4.6
10	250	26.1	8.0	15.1	4.6	14.2	4.3	31.0	9.5	17.9	5.5	16.9	5.1
12	300	28.4	8.7	16.2	4.9	15.3	4.7	33.8	10.3	19.3	5.9	18.2	5.5
14	350	30.1	9.3	17.4	5.3	16.4	5.0	36.1	11.0	20.7	6.3	19.5	5.9
16	400	32.5	9.9	18.4	5.6	17.4	5.3	38.7	11.8	21.9	6.7	20.6	6.3

⁽¹⁾ For fluid temperatures above 77°F (25°C) reduce span lengths 0.1-inch/°F (5 mm/°C)

⁽²⁾ Beam fixed at both ends and uniformly distributed loads. Intermediate spans may be calculate by multiplying the single span length by 1.2.

⁽³⁾ Fluid specific gravity.

Bending Radius⁽¹⁾

Nominal Pipe Size		Minimum Bending Radius		Maximum Deflection per 39-ft Joint	Minimum Length Required for 10° Change	
in	mm	ft	m	deg	ft	m
2	50	64	20	35	11	3
3	80	175	53	13	30	9
4	100	277	85	8	48	15
6	150	277	84	8	48	15
8	200	277	84	8	48	15
10	250	395	120	6	69	21
12	300	497	152	4	87	26
14	350	649	198	3	113	35
16	400	846	258	3	148	45

⁽¹⁾ At rated pressure. Sharper bends may create excessive stress concentrations.

Do not bend pipe until adhesive has cured.

Guide Specification

Pipe Construction

Pipe—The structural wall of fiberglass pipe in 2 through 16 inch nominal pipe sizes shall be constructed of continuous glass fibers wound in a matrix of anhydride cured epoxy resin in a dual angle pattern that takes optimum advantage of the tensile strength of the filaments. Pipe produced by filament-winding shall have a smooth outer surface with an outside diametral tolerance not exceeding $\pm 1.0\%$. The pipe shall incorporate an integral liner with a nominal thickness of 0.025 ± 0.005 inches for 2 through 16 inch nominal sizes. The pipe shall be manufactured in accordance with ASTM Standard D2996 for filament-wound reinforced thermosetting resin pipe (RTRP). When classified under ASTM Standard D2310, the pipe shall be Type 1, Grade 1, and Class F for 2 through 16 inch nominal pipe sizes.

Pipe shall be provided in standard lengths up to 40 feet, and shall be available in 60 ft. lengths on special request to minimize the number of field joints for rapid installation.

Pressure rating—Pipe in 2 through 16 inch sizes shall be rated for a minimum internal pressure of 150 psig at 150°F.

Fittings Construction

Fittings in 8 through 16 inch nominal sizes shall be filament wound and incorporate a resin-rich liner of equal or greater thickness than the pipe liner and shall be constructed of the same glass and resin type for corrosion and abrasion resistance equal to that of the pipe. Fittings in 2 through 6 inch nominal sizes may be compression molded from glass and resins similar to those used in the pipe. Sprayed-up fittings shall not be permitted.

Pipe and fittings shall be joined using bell and spigot taper/taper adhesive-bonded joints or mechanical screw-on type joints.

Physical and Mechanical Requirements

Values for physical and mechanical properties shall be no less than 95% of those shown tabulated above under Typical Physical Properties and Typical Mechanical Properties.

Workmanship

The pipe and fittings shall be free from all defects, including delamination, 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. Pigments or dyes may be used in the resin as long as the product is sufficiently translucent to verify the structural integrity of the structural wall. The pipe and fittings shall be as uniform as commercially practicable in color, density and other physical properties.

Testing

Quality control testing—Samples of pipe and fittings shall be tested at random based on standard quality control practices to determine conformance of the materials to the following ASTM guidelines for testing fiberglass pipe products: ASTM D1599, D2105, D2925, D2992A or D2992B. Test samples may be hydrostatically tested by the manufacturer to 1.5 times the pressure rating for signs of leakage.

Marking

Each component shall be marked to show the following:

- Manufacturer's name and address
- Nominal pipe size
- Hydrostatic test pressure (if so ordered)
- Date and shift of manufacture (pipe only)

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