Bondstrand™ Series 3000A Fiberglass Pipe for General Industrial Service

Uses and Applications

- Alcohol solutions
- Boiler feed water
- Bridge, roof and floor drains
- Brine and brackish water
- Chemical process piping
- Cooling water
- Demineralized water
- Fuel oil piping
- General service piping
- Mild chemicals
- Municipal waste
- Oilfield piping
- Potable water - NSF 61 Listed
- 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.

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

Temperatures to 210°F (99°C) maximum.

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 12), 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-11FU	RTRP-11FU1-6430
8 - 16	200 - 400	RTRP-11FU	RTRP-11FU1-3220

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, tees, 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

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.

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	2.0	0.069	1.7
3	80	3.50	89	3.33	85	0.085	2.2	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	162	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	Degree	in	mm	lb/ft	kg/m
2	50	1.75	1.5	38	0.50	0.75
3	80	1.75	1.7	43	0.70	1.05
4	100	1.75	1.9	48	1.00	1.50
6	150	1.75	2.8	71	1.90	2.85
8	200	2.00	2.6	66	3.10	4.60
10	250	2.00	3.1	79	4.50	6.70
12	300	2.00	3.6	91	6.10	9.10
14	350	2.00	4.2	107	7.50	11.15
16	400	2.00	4.7	119	9.40	14.00

Typical Pipe Performance

Nominal Pipe Size		Static Pressure[3] Rating at 150°F		Ultimate Internal Pressure[1]		Ultimate Collapse Pressure[2]			
						80°F	27°C	210°F	99°C
in	mm	psig	bar	psig	bar	psig	bar	psig	bar
2	50	450	31	2,160	149	165	11.4	151	10.4
3	80	400	28	1,579	109	66	4.6	60	4.2
4	100	325	22	1,258	87	34	2.3	31	2.1
6	150	300	21	1,275	88	35	2.4	32	2.2
8	200	150	10	605	42	16	1.1	14	1.0
10	250	150	10	678	47	16	1.1	14	1.0
12	300	150	10	741	51	17	1.2	15	1.1
14	350	150	10	739	51	15	1.0	14	1.0
16	400	150	10	749	52	14	1.0	13	0.9

[1] Quality control minimum

[2] For vacuum service above ground in sizes 8 inches and above consult NOV Fiber Glass Systems.

[3] At 210°F, derate 2”-6” sizes by a factor of 0.73 and 8”-16“ sizes by a factor of 0.63. Linearly interpolate derating factors for temperatures between 150°F and 210°F.

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	200	14	150	10	200	14	200	14
10	250	200	14	150	10	200	14	200	14
12	300	200	14	150	10	200	14	200	14
14	350	200	14	150	10	200	14	200	14
16	400	200	14	150	10	200	14	200	14

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 in 2 to 16 inch sizes. Ratings in 8 to 16 inch sizes are also applicable to elbows of other angles.

[2] ANSI B16.5 Class 150 psig bolt pattern.

[3] At 210°F, derate 2”-6” sizes by a factor of 0.73 and 8”-16“ sizes by a factor of 0.63. Linearly interpolate derating factors for temperatures between 150°F and 210°F.

Typical Physical Properties
(Biaxial Reinforcement Structure Wall)

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 (2 -16 inch - 77°F to 210°F)	10^{-6} in/in/°F 10^{-6} cm/cm/°C	10 to 13 18 to 24	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 2 - 6 in	Value 8 - 16 in	ASTM
Tensile Strength				
Longitudinal	10^3 psi	35	20	D2105
	MPa	240	138	
Circumferential	10^3 psi	70	40	D1599[4]
	MPa	483	276	
Tensile Modulus				
Longitudinal	10^6 psi	3.0	2.7	D2105
	GPa	21	19	
Circumferential	10^6 psi	4.2	3.6	—
	GPa	29	25	
Compressive Strength				
Longitudinal	10^3 psi	25	20	—
	MPa	169	138	
Compressive Modulus				
Longitudinal	10^6 psi	2.6	1.5	—
	GPa	18	10.3	
Long-Term Hydrostatic Design Basis[3]				
Static, Hoop Stress	10^3 psi	14.2	14.2	D2992 Procedure B
95% LCL 20-year Life @150°F/65°C	MPa	98.1	98.1	
Cyclic, Hoop Stress	10^3 psi	6.9	6.9	D2992 Procedure A
95% LCL 20-year Life @75°F/24°C	MPa	47.4	47.4	
Poisson's Ratio[2]				
ν_{yx}	—	0.17	0.17	—
ν_{xy}	—	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 free 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•in³/in²	N•m
2	50	0.236	3.27	76	8.5
3	80	0.331	4.58	96	10.9
4	100	0.420	5.82	105	11.9
6	150	0.416	5.76	350	39.5
8	200	0.597	7.21	401	45.3
10	250	0.599	7.24	766	86.5
12	300	0.588	7.11	1,303	147.2
14	350	0.609	7.36	1,722	194.5
16	400	0.622	7.51	2,408	272.1

(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[3]		1.3[3]	
in	mm	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
2	50	14.2	4.3	10.1	3.1	9.6	2.9	21.2	6.5	15.1	4.6	14.3	4.4
3	80	17.8	5.4	11.4	3.5	10.8	3.3	26.7	8.1	17.1	5.2	16.1	4.9
4	100	19.9	6.1	12.3	3.7	11.6	3.5	29.8	9.1	18.4	5.6	17.4	5.43
6	150	24.6	7.5	14.6	4.5	13.9	4.2	36.8	11.2	21.9	6.7	20.	6.3
8	200	27.9	8.5	16.4	5.0	15.5	4.7	41.8	12.7	24.6	7.5	23.1	7.0
10	250	31.4	9.6	18.1	5.5	17.1	5.2	46.9	14.3	27.1	8.2	25.5	7.8
12	300	34.0	10.4	19.4	5.9	18.3	5.6	50.9	15.5	29.0	8.8	27.3	8.3
14	350	36.2	11.0	20.7	6.3	19.5	5.9	54.2	16.5	31.0	9.5	29.2	8.9
16	400	38.7	11.8	21.9	6.7	20.6	6.3	57.9	17.6	32.8	10.0	30.9	9.4

[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

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	266	81	8	46	14
8	200	498	152	4	87	26
10	250	710	216	3	124	38
12	300	895	273	2	156	48
14	350	1,169	356	2	204	62
16	400	1,523	464	1	266	81

[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 aromatic amine 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 diametric tolerance not exceeding ±1.0%. The pipe shall incorporate an integral liner with a nominal thickness of 0.005, to 0.010 inches for 2 through 6-inch nominal sizes, and 0.025, ± 0.005 inches for 8 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 and capable of 210°F service conditions in accordance with the derating factor. In 2 through 6 inch sizes the pipe shall have a full vacuum capability at 80°F when installed above ground.

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. Contact molded, sprayed up or hand laid up fittings shall not be permitted.

Pipe and fittings shall be joined using bell and spigot taper/taper joints bonded with epoxy adhesive.

Physical and Mechanical Requirements

Measured values for physical and mechanical properties shall be within ±15% 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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