

# **Bondstrand™ Series 3200A Fiberglass Pipe**

## **(General Industrial Service)**

### **(For sizes 2 through 6 inch, use Series 3000A pipe and fittings products)**

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#### **Uses and Applications**

- Boiler feed water
- Brine and brackish water
- Chemical process piping
- Cooling water
- Demineralized water
- Electroplating
- Industrial plant piping
- Municipal waste
- Oilfield piping
- Potable Water - NSF 61 Listed
- Power plant and steel mill piping
- Sewer lines and sewer force mains
- Source and recycle water
- Sump discharge
- Vent lines
- Water mains
- Water treatment

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#### **Performance**

Pipe and fittings are rated at 200 psig.

Operating plus surge pressures to 1.25 times rated operating pressure occurring three times or less per 24-hour period.

No thrust blocks are required at rated system pressure for most buried piping configurations and most soil conditions. For above ground use, consult NOV Fiber Glass Systems.

Temperatures to 210°F (99°C) maximum. Sub-zero temperatures will not affect the physical properties. Water in pipe must not be allowed to freeze.

Vacuum to -14.7 psig when buried and properly backfilled. For above ground use, refer to collapse pressures listed below under pipe pressure Typical Pipe Performance.

Recommended burial depth: 3 to 25 feet.

Recommended for water, waste water (pH 1 to 12), and mild chemicals. Consult Bondstrand Corrosion Guide or contact NOV Fiber Glass Systems 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.**

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**Composition****Pipe**

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

Pipe Size		ASTM Designation	
in	mm	D2310	D2996
8 - 16	200 - 400	RTRP 11FU	RTRP 11FU1-6430

**Fittings**

8 to 16 inch:

Filament-wound fiberglass reinforced epoxy elbows

Mitered tees, crosses, wyes, and laterals

**Flanges**

Flange rings - Filament-wound fiberglass

Stub ends - Centrifugally cast fiberglass

**Blind flanges**

Reference CI3050 for fittings dimensions

**Adhesive**

NOV Fiber Glass Systems two-part epoxy adhesive for field fabrication.

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**Joining Systems**

8 to 16-inch:

Bell and spigot taper/taper adhesive-bonded joint.

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**Pipe Lengths**

Standard 20 and 39 foot random lengths.

Other lengths available on request.

### Typical Pipe Dimensions and Weights

Nominal Pipe Size		Outside Diameter <sup>(1)</sup>		Inside Diameter		Wall Thickness			
						Total		Structural	
in	mm	in	mm	in	mm	in	mm	in	mm
8	200	8.60	219	8.30	211	0.150	3.8	0.125	3.2
10	250	10.77	273	10.42	264	0.175	4.4	0.145	3.7
12	300	12.70	324	12.30	312	0.200	5.1	0.175	4.4
14	350	14.44	367	14.01	356	0.215	5.5	0.185	4.7
16	400	16.50	419	16.03	407	0.235	6.0	0.205	5.2

<sup>(1)</sup> Typical outside diameters of 8 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	deg	in	mm	lb/ft	kg/m
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 Rating at 150°F <sup>(3)</sup>		Ultimate Internal Pressure <sup>(1)</sup>		Ultimate Collapse Pressure <sup>(2)</sup>			
						80°F	27°C	210°F	99°C
in	mm	psig	bar	psig	bar	psig	bar	psig	bar
8	200	200	14	1074	74	21	1.5	18	1.2
10	250	200	14	994	69	17	1.2	14	1.0
12	300	200	14	1017	70	18	1.2	15	1.1
14	350	200	14	945	65	15	1.0	12	0.8
16	400	200	14	916	63	13	0.9	11	0.8

<sup>(1)</sup> Quality control minimum, biaxial loading

<sup>(2)</sup> For vacuum service above ground consult NOV Fiber Glass Systems.

<sup>(3)</sup> At 210°F derate the pipe by a factor of 0.73, linearly interpolate derating factors for temperatures between 150°F and 210°F.

### Fittings Pressure Ratings<sup>(3)</sup>

Nominal Pipe Size		Elbows and Tees <sup>(1)</sup>		Flanges <sup>(2)</sup>		Blind Flanges	
in	mm	psig	bar	psig	bar	psig	bar
8	200	200	14	200	14	200	14
10	250	200	14	200	14	200	14
12	300	200	14	200	14	200	14
14	350	200	14	200	14	200	14
16	400	200	14	200	14	200	14

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

<sup>(2)</sup> ANSI B16.5 150 psig bolt pattern

<sup>(3)</sup> At 210°F derate the pipe by a factor of 0.73, linearly interpolate derating factors for temperatures between 150°F and 210°F.

### Typical Physical Properties

Pipe Property	Units	Value	ASTM
Thermal conductivity	Btu-in/(h•ft <sup>2</sup> •°F) W/m•°C	1.7 0.25	C177
Coefficient of thermal expansion (linear) (8 - 16 inch)	10 <sup>-6</sup> in/in/°F 10 <sup>-6</sup> cm/cm/°C	10 to 13 18 to 24	D696 E228
Flow coefficient	Hazen-Williams	150.0	—
Absolute roughness	10 <sup>-6</sup> ft 10 <sup>-6</sup> m	50.0 15.0	—
Specific gravity	—	1.81	D792

### Typical Mechanical Properties

Pipe Property <sup>(1)</sup>	Units	Value	ASTM
Tensile strength Longitudinal	10 <sup>3</sup> psi MPa	35 240	D2105
Circumferential	10 <sup>3</sup> psi MPa	70 483	D1599 <sup>(4)</sup>
Tensile modulus Longitudinal	10 <sup>6</sup> psi GPa	2.7 21	D2105
Circumferential	10 <sup>6</sup> psi GPa	4.2 29	—
Compressive strength Longitudinal	10 <sup>3</sup> psi MPa	25 169	—
Compressive modulus Longitudinal	10 <sup>6</sup> psi GPa	2.7 18	—
Long-Term Hydrostatic Design Basis <sup>(3)</sup> Static, Hoop Stress 95% LCL 20-year Life @150°F/65°C	10 <sup>3</sup> psi MPa	14.2 98.1	D2992 Procedure B
Cyclic, Hoop Stress 95% LCL 20-year Life @75°F/24°C	10 <sup>3</sup> psi MPa	6.9 47.4	D2992 Procedure A
Poisson's Ratio <sup>(2)</sup> $\nu_{yx}$ $\nu_{xy}$	— —	0.17 0.15	— —

<sup>(1)</sup> Based on structural wall thickness.

<sup>(2)</sup> 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.

<sup>(3)</sup> Test fixtures were free end type (full end thrust on samples)

Nominal Pipe Size		Change in Length Due to Pressure <sup>(1)</sup>		Stiffness Factor <sup>(2)</sup>	
in	mm	in/100 ft/100 psi	mm/10m/10 bar	lb•in <sup>3</sup> /in <sup>2</sup>	N•m
8	200	0.565	6.8	582	65.7
10	250	0.612	7.4	908	102.6
12	300	0.599	7.2	1,596	180.3
14	350	0.646	7.8	1,886	213.0
16	400	0.668	8.1	2,566	289.9

<sup>(1)</sup> In an unrestrained system due to pressure effects alone.

<sup>(2)</sup> At 5% deflection.

### Support Spacing

(Values are based on a 1/2-inch (12 mm) deflection at mid span.)

Nominal Pipe Size		Single Span <sup>(1)</sup>						Continuous Span <sup>(2)</sup>					
		Gases		1.00 <sup>(3)</sup>		1.3		Gases		1.00		1.3	
in	mm	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
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	9.8	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

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

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

<sup>(3)</sup> 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
8	200	209	64	11	37	11
10	250	281	86	8	49	15
12	300	343	105	7	60	18
14	350	418	127	5	73	22
16	400	507	155	4	89	27

<sup>(1)</sup> At rated pressure. Sharper bends may create excessive stress concentrations.

**Do not** bend pipe until adhesive has cured.

# Guide Specification

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This specification covers approval, performance, materials and physical properties requirements for general industrial service piping in 8 through 16 inch nominal pipe sizes at operating temperatures to 210°F.

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## Performance Requirements

Pipe, fittings and other components furnished under this specification shall be rated for service to 200 psig at 150°F and capable of 210°F service conditions in accordance with the de-rating factor. All components shall be rated at or above the design pressure of the system.

Nominal Pipe Size		ASTM Designation	
in	mm	D2310	D2996
8 - 16	200 - 400	RTRP 11FU	RTRP 11FU-6430

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## Materials

**Liner**—All filament-wound pipe shall incorporate an integral liner with a nominal thickness of 0.025 ±0.005 inches for 8 through 16 inch nominal sizes. The resin system used in the liner shall be a chemically resistant thermosetting epoxy resin suitable for the intended service.

**Structural Wall**—Pipe shall be filament wound using continuous glass fiber reinforcements with a resin-compatible finish and a chemically resistant thermosetting epoxy resin. The glass filaments shall be wound in a dual-angle pattern that takes optimum advantage of the tensile strength of the filaments. The glass fiber content of the reinforced wall shall not be less than 60% by weight. Pigments or dyes may be used in the resin as long as the product remains translucent.

**External Surface**—The pipe shall have a typical 0.005 inch thick resin-rich coating with organic fibrous reinforcement. This protection must be provided for both above and below-ground pipe installations. All external surfaces must be resistant to anticipated corrosion imposed by the service and the environment.

**Fittings**—Fittings supplied under this specification shall be filament-wound, compression molded, centrifugally cast, or manufactured from mitered pipe sections. The glass fiber content of the structural portion of compression-molded and filament-wound fittings shall not be less than 55% by weight.

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## Joining Methods

**Adhesive-Bonded Bell and Spigot**—Both tapered bell and tapered spigot shall have matching taper angles and shall be joined by bonding with an epoxy adhesive. The nominal taper angle shall be 2° on 8 through 16 inch nominal pipe sizes. The adhesive shall be a two-part epoxy supplied as a kit with all necessary application materials.

**Flanges**—Flanges shall be two-piece Van Stone type provided with raised grooves on the sealing surface. Fiberglass-reinforced, compression-molded or centrifugally cast stub ends are to be adhesive bonded to the pipe or fitting.

**Adapters or Crossovers**—The following adapters or crossovers shall be available on request:

Grooved end (8 inch nominal pipe sizes)

Cast iron pipe end (8 through 16 inch nominal pipe sizes)

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## Pipe Construction

**Pipe**—Pipe shall be manufactured to steel pipe outside diameters in 8 through 12 inch nominal pipe sizes and should be based on nominal inside diameters in 14 inch sizes and above. Outside diameter tolerances shall not exceed  $\pm 1.0\%$ . Pipe shall be provided in 40 feet random lengths (34 through 42 ft) unless otherwise specified. Up to 10 percent shorts may be included in any shipment unless otherwise agreed upon in writing between purchaser and manufacturer.

**Wall Thickness**—The total wall thickness of pipe furnished to this specification shall not at any point be greater than 120 percent nor less than 87.5 percent of the nominal thickness. Nominal wall thickness shall have dimensions as given in the manufacturer's published literature.

**Fittings and Flanges**—Fittings and flanges shall have dimensions as given in the manufacturer's published literature. Flanges shall be drilled to match ANSI 816.5, Class 150 unless specified otherwise in the purchase order.

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## Physical and Mechanical Requirements

Values for physical and mechanical properties shall be within 15% of those shown tabulated above under Typical Physical Properties and Typical Mechanical Properties.

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## 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.

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## 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 tests: weight, taper angle, short-term rupture strength, cyclic pressure performance, ring crush strength, Barcol hardness and degree of cure. Each item shall be visually inspected for workmanship.

**Proof Testing**—All components may be required to be hydrostatically tested by the manufacturer to 1.5 times the pressure rating for signs of leakage or porosity.

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## Marking

Each component shall be marked to show the following:

- Manufacturer's name and address
- Nominal pipe size
- Pressure class
- Hydrostatic test pressure (if so ordered)
- UL Listing Mark (if so ordered)
- ULC Listing Mark (if so ordered)
- Date and shift of manufacture (pipe only)



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