

Bondstrand™ 2000 Guide Specification

Scope This specification defines the reinforced thermosetting resin (RTR) piping system to be used in those sections of Plant Piping—General Services calling for fiberglass piping systems.

References, Quality Assurance References are made to other standards and tests which are a part of this section as modified. Where conflict exists between the requirements of this specification and listed references, the specification shall prevail.

Physical and Mechanical Properties

Pipe Property	Units	70°F 21°C		200°F 93°C		ASTM Method
		1", 1 1/2" 8"-16"	2"-6"	1", 1 1/2" 8"-16"	2"-6"	
Circumferential						
Tensile stress at weeping	10 ³ psi MPa	24.00 165.00	32.00 22.00	- -	- -	D1599
Tensile modulus	10 ⁶ psi GPa	3.65 25.20	4.20 29.00	3.20 22.10	3.70 25.50	
Poisson's ratio		0.56	0.26	0.70	0.32	D2105
Longitudinal						
Tensile strength	10 ³ psi MPa	8.50 58.60	16.00 110.00	6.90 47.60	13.00 90.00	D2105
Tensile modulus	10 ⁶ psi GPa	1.60 11.00	3.00 20.70	1.24 8.50	2.40 16.50	D2105
Poisson's ratio		0.37	0.16	0.41	0.20	D2105
Beam apparent						
Elastic modulus	10 ⁶ psi GPa	1.70 11.70	2.40 16.60	1.00 6.90	1.77 12.20	D2925
Hydrostatic design basis (cyclic)	10 ³ psi MPa	6.00 41.40 ¹	16.00 ^{1,2} 110.00	- -	- -	D2992
Thermal conductivity						
Pipe wall	Btu•in/(hr•ft ² •°F) W/m•°C	2.00 0.29	1.70 10.25	- -	- -	C177
Thermal expansion						
Linear	10 ⁻⁶ in/in/°F 10 ⁻⁶ mm/mm°C	10.00 18.00	8.50 15.30	- -	- -	D696
Flow coefficient	Hazens-Williams	150.00	150.00	-	-	-
Absolute roughness	10 ⁻⁶ ft 10 ⁻⁶ m	17.40 5.30	17.40 3.30	- -	- -	-
Specific gravity	-	1.80	1.80	-	-	D792
Density	lb/in ³ g/cm ³	0.07 1.80	0.07 1.80	- -	- -	-

1) At 150°F (66°C)
2) Static

Performance Requirements

The pipe in sizes 1" through 16" must comply with U.S. Federal Regulations 21CFR 175.105 and 21CFR 177.2280 for conveying foodstuffs when joined with RP6B epoxy adhesive. Pipe shall be listed under NSF Standard 61-Drinking Water System Components. Piping must meet or exceed the requirements of MIL-P-29206A and ASTM D5677-95 when used in aviation fuel service. Fittings will be manufactured according to ASTM D5685. Piping will be manufactured according to ASTM D2996 for RTRP. When classified under ASTM D2310, the pipe shall meet Type I, Grade I and Class F (RTRP-11FE) cell limits in 1" through 16" nominal pipe sizes.

Materials

Pipe Construction

Filament-wound fiberglass reinforced epoxy resin pipe shall be Bondstrand 2000 as manufactured by FGS, or approved equal. The integral reinforced corrosion barrier shall have a nominal 20 mil thickness, and be constructed with the same epoxy resin as the pipe structural wall. Non-reinforced liners, or corrosion barriers, shall not be allowed due to potential for fracturing during lower temperatures, transportation and installation.

Structural wall

The pipe shall have the following nominal wall thickness:

Pipe end preparation options

The piping manufacturer will provide 20' or 40' RL joints if the contractor requests them in sizes 2" through 6" to reduce field labor time in those sections of the system where longer lengths may be employed. Additionally, the pipe manufacturer will provide pipe joints with the spigot ends already prepared to reduce field labor time on all pipe sizes (2" -16").

Pressure rating

Aromatic amine cured epoxy resin piping shall be rated for a minimum of 165 psi at 200°F in sizes through 16". Pressure ratings reduce linearly to 50% at 250°F.

Pipe Diameter	Nominal Wall Thickness	
	in	mm
1	.140	3.5
1 1/2	.140	3.5
2	.123	3.1
3	.126	3.2
4	.151	3.8
6	.181	4.6
8	.226	5.7
10	.226	5.7
12	.226	5.7
14	.250	6.4
16	.269	6.8

Fittings

It is important to maintain compatibility of fittings, piping and adhesives to ensure that the system performs as specified. Pipe, fittings and adhesive shall be supplied by the same manufacturer.

Filament-wound fittings

Fittings in 1" through 16" sizes shall be filament-wound with a reinforced resin-rich liner of equal or greater thickness than the pipe liner and shall be manufactured with the same resin type as the pipe.

Compression-molded fittings

Compression molded fittings in sizes 2" through 6" may be used in services at or below 200°F. Where fast closure of valves may produce surges (water hammer), filament-wound fittings will be used.

Contact molded, spray up or hand lay-up fittings shall not be allowed.

Testing

Inspection and testing

Inspection and testing of the piping will be performed in accordance with the requirements of ASME B31.1. Hydrostatic testing of all installed piping shall be performed with water at 1 1/2 times the design pressure of the lowest rated piping system component.

Test and repair procedures

The RTRP manufacturer will provide test and repair procedures in the event field repairs are required.

Installation

Installation procedures and techniques as well as system design criteria including burial, anchoring, guiding and supporting shall be in accordance with manufacturer's recommendations.

Piping system installers and fitters will be trained by a direct factory employee of the piping system manufacturer and certified by the trainer prior to system assembly in the field.

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North America

17115 San Pedro Ave. Suite 200
San Antonio, Texas 78232 USA
Phone: 210 477 7500

South America

Estrada de Acesso á Zona
Industrial Portuária de Suape, s/no.
Recife, PE, Brazil 55.590-000
Phone: 55 81 3501 0023

Europe

P.O. Box 6, 4190 CA
Geldermalsen, The Netherlands
Phone: 31 345 587 587

Asia Pacific

No. 7A, Tuas Avenue 3
Jurong, Singapore 639407
Phone: 65 6861 6118

Middle East

P.O. Box 17324
Dubai, UAE
Phone: 971 4881 3566