

Bondstrand™ 5000/5000C Product Data

(Severely Corrosive Industrial Service and Oxidizing Acids)

Uses and Applications

- Acid drains
 - Bleach processing
 - Chemical process piping
 - Chlorinated water
 - Chlorine
 - Corrosive slurries
 - Food processing plant
 - Organic chemicals
 - Oxidizing chemicals and acids
 - Phosphoric acid
 - Water Treatment/Purification
 - General industrial service for severely corrosive liquids
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Listings

Classification Approval from LRS, DNVGL, AB and BV.

Performance

Working pressure from 150 to 232 psig (10 to 16 bar) depending on pipe size.

Operating temperatures to 200°F (93°C). Subzero temperatures will not adversely affect mechanical properties.

Excellent corrosion resistance over a wide temperature range. See most recent release of Bondstrand Corrosion Guide for specific applications.

Does not require thrust blocks at ambient temperatures when properly installed in most soils.

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

Low thermal conductivity minimizes heat losses.

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.

Optional: The system can be supplied conductive - Bondstrand 5000C

For Conductive ASTM D-2310 Classification: RTRP-11FW for pipes or RTRP-11FE as applicable.

Composition

Pipe

Filament-wound fiberglass-reinforced vinyl ester pipe with integral 0.050-inch (1.3 mm) resin-rich reinforced liner.

Nominal Pipe Size		ASTM Designation
in	mm	D2996
1-6	25-150	RTRP 11FW-1012/11FE-1012
8-16	200-400	RTRP 11FW-1013/11FE-1013

Tees

90° and 45° elbows

Crosses

Nipples and couplings

45° laterals

Tapered body reducers

Molded fittings

Tees (1 to 6 inch only)

90° and 45° elbows (1 to 6 inch only)

Reducing flanges

Plugs and end-caps

Flanges

Filament-wound, molded or laminated flanges with ANSI B16.1 and ANSI B16.5 drilling

Molded reducing and blind flanges

Thermosetting adhesives

RP106 two-part vinylester for 5000/5000C

Joining systems

Quick-Lock® straight/taper adhesive-bonded joint featuring integral pipe stop in bell for predictable, precise laying lengths plus overwrap on joint for enhanced joint performance.

Flanges and flanged fittings.

Pipe Lengths

Nominal Pipe Size		Random Lengths	
in	mm	ft	m
1 - 1½	25 - 42	10	3
2 - 6	50 - 150	30	9
8 - 16	200 - 400	40	12

Elbows

Tees

Flanges, blind flanges and reducing flanges

Plugs and end-caps

Crosses

Nipples and couplings

45° laterals

Tapered body reducers

Tapered body reducers, tees and 90° and 45° elbows are available with any combination of Quick-Lock female and filament-wound, molded or laminated flange ends.

Laying lengths of filament-wound fittings with Quick-Lock ends match those of ANSI B16.9 steel butt welding fittings. Flanged ends match ANSI B16.1 and B16.5 center-to-face and face-to-face dimensions.

Typical Pipe Dimensions and Weights

Nominal Pipe Size ⁽¹⁾		Pipe I.D.		Nominal Wall Thickness ⁽²⁾		Average Sectional Area ⁽³⁾		Pipe Weight	
in	mm	in	mm	in	mm	in	mm ²	lb/ft	kg/m
1	25	1.07	27.3	0.14	3.5	0.53	340	0.4	0.6
1½	40	1.67	42.3	0.14	3.5	0.79	510	0.61	0.9
2	50	2.10	53.0	0.15	3.9	1.13	730	1.0	1.2
3	80	3.22	82.0	0.16	4.0	1.70	1100	1.5	1.7
4	100	4.14	105.0	0.20	5.1	2.73	1760	2.4	2.8
6	150	6.20	159.0	0.20	5.1	4.06	2620	3.5	4.2
8	200	8.22	209.0	0.23	5.7	5.83	3760	5.0	6.1
10	250	10.35	263.0	0.23	5.7	7.31	4710	6.2	7.7
12	300	12.35	314.0	0.23	5.7	8.69	5600	7.4	9.1
14	350	13.56	344.0	0.25	6.4	10.85	7000	8.7	11.0
16	400	15.50	394.0	0.29	7.3	14.18	9150	11.2	14.0

1) For availability of 1, 1½, 14 and 16-inch (25, 40, 350 and 400 mm) sizes, consult your FGS representative.

2) Minimum wall thickness shall not be less than 87.5% of nominal wall thickness in accordance with ASTM D2996.

3) Use these values for calculating longitudinal thrust.

Typical Pipe Performance

Nominal Pipe Size		Internal Pressure Rating		Collapse Pressure Rating ⁽¹⁾	
in	mm	psig	Mpa	psig	Mpa
1	25	450	3.10	212	1.46
1½	40	450	3.10	212	1.46
2	50	450	3.10	212	1.46
3	80	320	2.21	68	0.47
4	100	350	2.41	82	0.56
6	150	249	1.72	24	0.17
8	200	225	1.55	16	0.11
10	250	175	1.21	8	0.06
12	300	150	1.03	5	0.03
14	350	150	1.02	5	0.03
16	400	150	1.02	6	0.04

1) At 70°F (21°C). Reduce linearly to 84% at 140°F (60°C), 76% at 170°F and 50% at 200°F (93°C).

Fittings Pressure Ratings

Nominal Pipe Size		Elbows & Tees				Tapered Body Reducers & Flanges		Blind Flanges & Bushed Saddles	
		Filament-Wound		Molded					
in	mm	psig	MPa	psig	MPa	psig	MPa	psig	MPa
1	25	300	2.07	200	1.38	450	3.10	150	1.03
1½	40	300	2.07	200	1.38	450	3.10	150	1.03
2	50	300	2.07	200	1.38	450	3.10	150	1.03
3	80	275	1.89	150	1.03	350	2.41	150	1.03
4	100	200	1.38	150	1.03	350	2.41	150	1.03
6	150	175	1.21	150	1.03	250	1.72	150	1.03
8	200	225	1.03	-	-	225	1.55	150	1.03
10	250	150	1.03	-	-	175	1.21	150	1.03
12	300	150	1.03	-	-	150	1.03	150	1.03
14	350	150	1.03	-	-	150	1.03	150	1.03
16	400	150	1.03	-	-	150	1.03	150	1.03

1) Use Bondstrand Series 2000 epoxy saddles with 316 stainless steel outlet. Other outlet materials available on special order.

Nominal Pipe Size		Laterals		Crosses		Reducer Bushing	
in	mm	psig	MPa	psig	MPa	psig	MPa
1	25	275	1.00	150	1.03	50	.35
1½	40	275	1.00	150	1.03	50	.35
2	50	275	1.90	150	1.03	50	.35
3	80	250	1.72	150	1.03	50	.35
4	100	200	1.38	150	1.03	50	.35
6	150	150	1.03	100	0.69	50	.35
8	200	150	1.03	100	0.69	50	.35
10	250	150	1.03	100	0.69	50	.35
12	300	150	1.03	100	0.69	50	.35
14	350	150	1.03	100	0.69	50	.35
16	400	150	1.03	100	0.69	50	.35

1) Reducer bushings bonded into flanges will have the same rating as the flange. Otherwise, rated as shown.

Typical Physical Properties

Typical Physical Properties			
Pipe Property	Units	Value	ASTM
Thermal conductivity	Btu-in/(h•ft ² •°F) W/m•°C	2.0 0.28	C177
Coefficient of thermal expansion (linear) (2 -16 inch) 77°F to 150°F (25°C to 65°C)	10 ⁻⁶ in/in/°F 10 ⁻⁶ cm/cm/°C	10 18	D696
Flow coefficient	Hazen-Williams	150.00	—
Absolute roughness	10 ⁻⁶ ft 10 ⁻⁶ m	17.40 5.30	—
Specific gravity	—	1.80	D792
Density	lb/in ³	0.07	

Typical Physical Properties

Typical Mechanical Properties			
Pipe Property ⁽¹⁾	Units	Value	ASTM
		2" - 16"	
Tensile strength Longitudinal	10 ³ psi	10.8	D2105
	MPa	74.5	
Circumferential	10 ³ psi	77.2	D1599
	MPa	53.2	
Tensile modulus Longitudinal	10 ⁶ psi	2.79	D2105
	GPa	19.24	
Circumferential	10 ⁶ psi	3.94	—
	GPa	27.17	
Long-term hydrostatic ⁽²⁾ Design basis Static, Hoop Stress LCL 20 Year Life @150°F (65°C)	10 ³ psi MPa	12.8	D2992(B)
		88.3	
Poisson's Ratio ⁽³⁾ v_{ah} v_{ha}	—	0.32	—
	—	0.61	—

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

(2) Test fixtures were "free end" type. Specimens were stressed by internal pressure in both hoop and longitudinal directions.

(3) v_{ha} = The ratio of axial strain to hoop strain resulting from stress in the hoop direction.

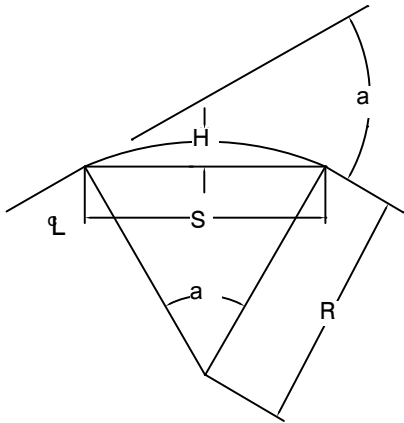
v_{ah} = The ratio of hoop strain to axial strain resulting from stress in the axial direction.

Nominal Pipe Size		Stiffness Factor ⁽¹⁾		Pipe Stiffness ⁽¹⁾		Beam Moment of Inertia ⁽²⁾	
in	mm	lb•in	N•m	psi	MPa	in ⁴	10 ⁶ mm ⁴
1	25	340	38.4	1540	10.60	0.48	0.20
1½	40	340	38.4	1540	10.60	0.48	0.20
2	50	340	38.4	1540	10.60	0.48	0.20
3	80	340	38.4	460	3.20	1.61	0.67
4	100	820	92.6	530	3.70	4.70	1.96
6	150	820	92.6	160	1.10	15.50	6.40
8	200	1180	133.3	105	0.72	39.00	16.30
10	250	1180	133.3	53	0.37	77.00	32.00
12	300	1180	133.3	31	0.23	129.00	54.00
14	350	1330	150.2	36	0.25	209.00	88.00
16	400	2190	247.4	38	0.26	368.00	154.00

1) Per ASTM D2412

2) Use these values to calculate permissible spans.

Bending Radius



Nominal Pipe Size		Bending Radius ¹ (R)		Maximum Allowable ⁽²⁾ (H)		Turning Angle
in	mm	lb•in	N•m	ft	m	a
1	25	69.4	21	17.5	5.3	84
1½	40	69.4	21	17.5	5.3	84
2	50	69.4	21	17.5	5.3	84
3	80	101.1	31	12.1	3.7	57
4	100	129.9	40	9.5	2.9	44
6	150	191.8	58	6.5	1.9	30
8	200	250.0	76	5.0	1.5	23
10	250	312.0	95	4.0	1.2	18
12	300	370.0	113	3.4	1.0	15
14	350	410.0	125	3.2	0.9	14
16	400	410.0	143	2.7	0.8	12

1) Do not bend pipe until adhesive has cured. At rated pressure sharper bends may create excessive stress concentrations.

2) For 100-ft (30m) bending length, S

Buried Installations

Live loads

Bondstrand 5000/5000C will carry H20 wheel loadings of at least 16,000 lb (7250 kg) per axle when properly bedded in compacted sand in stable soils and provided with at least 3 ft (1 m) of cover.

Thrust blocks

Most properly bedded installations do not require thrust blocks. Consult FGS for recommendations for systems operating at elevated temperatures.

Nominal Pipe Size		Maximum Earth Cover ¹					
		100 psi	0.69 MPa	125 psi	0.86 MPa	150 psi	1.03 MPa
in	mm	ft	m	ft	m	ft	m
1	25	30	9.14	30	9.14	30	9.14
1½	40	30	9.14	30	9.14	30	9.14
2	50	30	9.14	30	9.14	30	9.14
3	80	30	9.14	30	9.14	30	9.14
4	100	30	9.14	30	9.14	30	9.14
6	150	30	9.14	24	7.32	23	7.01
8	200	23	7.01	22	6.71	21	6.40
10	250	23	7.01	21	6.40	19	5.79
12	300	23	7.01	21	6.40	18	5.49
14	350	23	7.01	21	6.40	17	5.18
16	400	23	7.01	20	6.10	16	4.88

1) Based on a 120lb/ft³ (1925 kg/m³) soil density and 1000 psi (6.9 MPa) modulus of soil reaction.

Span Lengths

Recommended maximum support spacings for Bondstrand 5000/5000C vinyl ester pipe at various operating temperatures. Values based on 0.5-inch (12 mm) deflection at midspan for fluid specific gravity = 1.0. For fully continuous spans, values may be increased up to 20%. Decrease values by 20% for single spans.

Nominal Pipe Size		Spans (ft)			
in	mm	100°F	140°F	170°F	200°F
1	25	9.3	8.9	8.7	6.78
1½	40	10.7	10.2	9.2	7.1
2	50	12.1	10.8	9.4	7.5
3	80	13.7	12.3	10.7	8.6
4	100	16.1	14.5	12.6	10.0
6	150	18.1	16.1	14.2	11.2
8	200	20.1	18.1	15.5	12.6
10	250	21.4	19.2	16.6	13.5
12	300	22.3	20.2	17.5	13.9
14	350	23.1	20.7	18.1	14.4
16	400	24.3	21.6	18.9	15.0

1) Span recommendations are intended for normal horizontal piping support arrangements, but include no provision for weights (fittings, valves, flanges, etc) or thrusts (branches, turns, etc.).

2) Span recommendations are calculated for a maximum long-term deflection of ½ inch to ensure good appearance and adequate drainage.

Field Testing

Bondstrand 5000/5000C piping systems are designed for hydrostatic field testing at 150% of rated operating pressure. Pneumatic testing is not recommended.

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