

# Bondstrand™ 5000/5000C Product Data

## (Severely Corrosive Industrial Service and Oxidizing Acids)

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### 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

Meets USFDA requirements for food processing piping under Federal Regulations 21CFR175.105 and 21CFR177.2420 when assembled with RP-105B vinyl ester adhesive for 5000 andn RP-106 for 5000C (conductive).

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### Performance

Working pressure from 150 to 450 psig (1 to 3.1 MPa) 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.

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## 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
2-6	50-150	RTRP 11FW-1012/11FE-1012
8-16	200-400	RTRP 11FW-1013/11FE-1013

### Filament-wound fittings

Tees

90° and 45° elbows

Crosses

Nipples and couplings

45° laterals

Tapered body reducers

### Molded fittings

Tees (2 to 6 inch only)

90° and 45° elbows (2 to 6 inch only)

Reducing flanges

Plugs and end-caps

### Flanges

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

Molded reducing and blind flanges

### Thermosetting adhesives

RP105B two-part vinyl ester for 5000

RP106 two-part vinyl ester for 5000C

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## Joining systems

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

Flanges and flanged fittings.

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## Pipe Lengths

Nominal Pipe Size		Random Lengths	
in	mm	ft	m
2-8	50-150	30	9
10-16	200-400	20	6

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 or molded flange ends.

Laying lengths of filament-wound fittings with Quick-Lock ends match those of ANSI B16.9 steel buttwelding 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 <sup>(1)</sup>		Pipe I.D.		Nominal Wall Thickness <sup>(2)</sup>		Average Sectional Area <sup>(3)</sup>		Pipe Weight	
in	mm	in	mm	in	mm	in	mm <sup>2</sup>	lb/ft	kg/m
2	50	2.10	53	.15	3.9	1.13	730	1.0	1.2
3	80	3.22	82	.16	4.0	1.70	1100	1.5	1.7
4	100	4.14	105	.20	5.1	2.73	1760	2.4	2.8
6	150	6.20	159	.20	5.1	4.06	2620	3.5	4.2
8	200	8.22	209	.226	5.7	5.83	3760	5.0	6.1
10	250	10.35	263	.226	5.7	7.31	4710	6.2	7.7
12	300	12.35	314	.226	5.7	8.69	5600	7.4	9.1
14	350	13.56	344	.250	6.4	10.85	7000	8.7	11.0
16	400	15.50	394	.286	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 <sup>(1)</sup>	
in	mm	psig	Mpa	psig	Mpa
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
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
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 <sup>2</sup> •°F)	2.0	C177
	W/m•°C	0.28	
Coefficient of thermal expansion (linear) (2 -16 inch) 77°F to 150°F (25°C to 65°C)	10 <sup>-6</sup> in/in/°F	10	D696
	10 <sup>-6</sup> cm/cm/°C	18	
Flow coefficient	Hazen-Williams	150.00	—
Absolute roughness	10 <sup>-6</sup> ft	17.40	—
	10 <sup>-6</sup> m	5.30	
Specific gravity	—	1.80	D792
Density	lb/in <sup>3</sup>	0.07	

**Typical  
Physical  
Properties**

<b>Typical Mechanical Properties</b>			
Pipe Property <sup>(1)</sup>	Units	Value	ASTM
		2" - 16"	
Tensile strength Longitudinal	10 <sup>3</sup> psi	7.0	D2105
	MPa	48.3	
Circumferential	10 <sup>3</sup> psi	18.5	D1599
	MPa	128.0	
Tensile modulus Longitudinal	10 <sup>6</sup> psi	1.45	D2105
	GPa	10.1	
Circumferential	10 <sup>6</sup> psi	3.13	—
	GPa	21.6	
Compressive strength Longitudinal	10 <sup>3</sup> psi	20.0	—
	MPa	138.0	
Compressive modulus Longitudinal	10 <sup>6</sup> psi	1.5	—
	GPa	10.3	
Long-term hydrostatic <sup>(3)</sup> Design basis			
Static, Hoop Stress	10 <sup>3</sup> psi	12.8	D2992(B)
LCL 20 Year Life @150°F (65°C)	MPa	88.2	
Cyclic, Hoop Stress	10 <sup>3</sup> psi	—	D2992(A)
LCL 20 Year Life @150°F (65°C)	MPa	—	
Poisson's Ratio <sup>(2)</sup>			
	$\nu_{yx}$	—	0.19
	$\nu_{xy}$	—	0.11

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

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

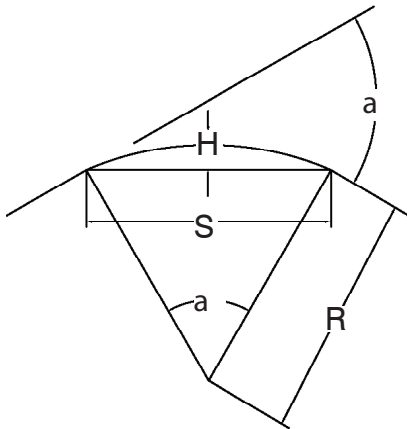
(3) Test fixtures were end type (full end thrust on samples).

Nominal Pipe Size		Stiffness Factor <sup>(1)</sup>		Pipe Stiffness <sup>(1)</sup>		Beam Moment of Inertia <sup>(2)</sup>	
in	mm	lb•in	N•m	psi	MPa	in <sup>4</sup>	10 <sup>6</sup> mm <sup>4</sup>
2	50	340	38.4	1540	10.6	0.48	0.20
3	80	340	38.4	460	3.2	1.61	0.67
4	100	820	92.6	530	3.7	4.7	1.96
6	150	820	92.6	160	1.1	15.5	6.40
8	200	1180	133.3	105	0.72	39	16.3
10	250	1180	133.3	53	0.37	77	32
12	300	1180	133.3	31	0.23	129	54
14	350	1330	150.2	36	0.25	209	88
16	400	2190	247.4	38	0.26	368	154

1) Per ASTM D2412.

2) Use these values to calculate permissible spans.

## Bending Radius



Nominal Pipe Size		Bending Radius <sup>1</sup> (R)		Maximum Allowable <sup>(2)</sup> (H)		Turning Angle
in	mm	lb•in	N•m	ft	m	a
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	76	5.0	1.5	23
10	250	312	95	4.0	1.2	18
12	300	370	113	3.4	1.0	15
14	350	410	125	3.2	0.9	14
16	400	410	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 <sup>1</sup>					
		100 psi	0.69 MPa	125 psi	0.86 MPa	150 psi	1.03 MPa
in	mm	ft	m	ft	m	ft	m
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/ft<sup>3</sup> (1925 kg/m<sup>3</sup>) soil density and 1000 psi (6.9 MPa) modulus of soil reaction.

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## 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
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.

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## 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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CI5000 - April 2013