

Bondstrand Series 7000M Fiberglass Pipe and Fittings

for shipboard and offshore platform service

Uses and applications

Ballast (adjacent to tanks)	Portable discharge lines
Crude oil washing	Sounding tubes/vent cargo piping
Deck hot air drying (cargo tanks)	Stripping lines
Petroleum cargo lines	

Listings and approvals

American Bureau of Shipping (U.S.)	Lloyd's Register of Shipping (U.K.)
Bureau Veritas (France)	Nippon Kaiji Kyokai
Canadian Coast Guard	Polski Rejestr Statków
Det norske Veritas	Registro Italiano Navale
Dutch Scheepvaartinspectie	United States Coast Guard
Germanischer Lloyd	Russian Register of Shipping

Performance

Bondstrand Series 7000M fiberglass pipe, fittings and flanges incorporate high-strength conductive filaments (U.S. Patent No. 4,330,811) to prevent accumulation of potentially dangerous levels of static electrical charges by the flow of liquids such as refined petroleum products. Series 7000M piping systems are made electrically conductive by using a conductive Ameron adhesive (U.S. Patent No. 4,874,548) in the adhesive-bonded joint and for mounting flanges. Accumulated charges are harmlessly drained from the fiberglass pipe system into the metallic structure of the ship by means of stainless steel cables embedded in fiberglass grounding saddles. The saddles are adhesive bonded in the field by the installer to the external wall of the pipe.

Series 7000M fiberglass piping meets all applicable requirements of ASTM F1173.

Pipe and fittings are available for continuous operating pressures of 150 psi (10 bar) or 225 psi (16 bar) at 200°F. Minimum collapse pressure of pipe and fittings is not less than 125 psi at 200°F (8.6 bar at 93°C) to withstand external pressure at bottom of filled cargo or ballast tanks under full vacuum.

Pipe lengths

Bondstrand marine pipe is produced in different lengths depending on pipe diameter and the location of manufacture. Pipe can be cut to specified lengths at the factory. Consult your Ameron representative.

Nominal Pipe Size		Length	
(in)	(mm)	(ft)	(m)
1 - 1½	25 - 40	10*	3.0
2 - 8	50 - 200	30*	9.1
10 - 16	250 - 400	20*	6.1
18 - 40	450 - 1000	40	12.2

* In U.S. Other lengths may be available outside of U.S.

Composition

Pipe — Filament-wound fiberglass-reinforced epoxy pipe with conductive filaments in pipe wall.

Fittings — Wide range of lined filament-wound epoxy fittings with fiberglass strands and conductive veils employing Quick-Lock® adhesive-bonded joint in 1 to 16-inch (25 to 400 mm) sizes or flanged ends in all sizes.

Flanges — Filament-wound epoxy reinforced with fiberglass strands and conductive filament.

Blind flanges — Compression-molded nonconductive epoxy in 2 to 12-inch sizes (50 to 300 mm) sizes.

Grounding saddles — Filament-wound fiberglass with stainless steel grounding cable.

Adhesive — PSX™•60 two-part thermosetting electrically conductive epoxy.

Fittings and flanges

See Bondstrand Product Data, SERIES 2000M AND 7000M FITTINGS, FP169, for dimensions, shipping weights and pressure ratings.

Fittings

90° and 45° elbows
Tees and reducing tees
45° laterals
Crosses
Couplings and nipples

Reducers
Reducing saddles furnished with

- Quick-Lock socket outlet
- flanged outlet
- metallic bushing outlet

Flanges

Series 7000M flanges are offered in two configurations:

- heavy-duty (hubless)
- loose ring (van Stone)

Bondstrand marine flanges are produced with the following drillings for easy connection to piping systems currently in common use; other drillings, as well as undrilled flanges, are available:

- | | |
|-----------------------------------|-----------------------------------|
| • ANSI B16.1 CI 125 (26 to 40 in) | • ISO 2084 NP-10 |
| • ANSI B16.5 CI 150 (1 to 24 in) | • ISO 2084 NP-16 |
| • ANSI B16.5 CI 300 (1 to 24 in) | • JIS B2211 5 kg/cm ² |
| • API 605 CI 150 | • JIS B2212 10 kg/cm ² |
| • API 605 CI 300 | • JIS B2213 16 kg/cm ² |

See Bondstrand Product Data, SERIES 2000M AND 7000M FLANGES, FP168, for dimensions and weights for the drillings given above.

Typical physical properties

Pipe Property	Units	Value	Method
Thermal conductivity of pipe wall	Btu•in/(hr•ft ² •°F)	2.3	Ameron
	W/m•°C	0.33	
Thermal expansion, linear	10 ⁻⁶ in/in/°F	10	Ameron
	10 ⁻⁶ mm/mm°C	18	
Flow coefficient	Hazen-Williams	150	—
Absolute roughness	10 ⁻⁶ ft	17.4	—
	10 ⁻⁶ m	5.3	—
Specific gravity	—	1.79	—
Shielding capability	volts	100 ¹	—
Grounding resistance @ 1500 volts	10 ⁶ ohms	1.0 ¹	—

1) Maximum value when measured in accordance with Annexes 2 and 3 of ASTM 1173.

Typical mechanical properties

Pipe Property	Units	70°F (21°C)	200°F (93°C)	Method
Circumferential				
Tensile stress at weeping	10 ³ psi MPa	24.0 165	18.5 128	ASTM D1599
Tensile modulus	10 ⁶ psi GPa	3.65 25.2	3.20 22.1	Ameron
Poisson's ratio		0.56	0.70	Ameron
Longitudinal				
Tensile strength	10 ³ psi MPa	8.50 59.0	6.90 44.6	ASTM D2105
Tensile modulus	10 ⁶ psi GPa	1.60 11.1	1.24 8.50	ASTM D2105
Poisson's ratio		0.37	0.41	ASTM D2105
Beam apparent				
Elastic modulus	10 ⁶ psi GPa	1.70 11.7	1.00 6.90	ASTM D2925
Hydrostatic design basis (cyclic) ¹				
	10 ³ psi MPa	6.0 41.4	— —	ASTM D2992A

1) At 150°F (66°C).

Typical pipe dimensions

Series 7000M pipe dimensions conform to Iron Pipe Size (IPS*) ODs in 1 to 36-inch sizes and Marine Cast Iron (MCI**) ODs in 14 to 40-inch sizes.

Nominal Pipe Size	Pipe Inside Diameter		Nominal Wall Thickness		Nominal O.D.		Shipping Weight		
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(lb/ft)	(kg/m)	
1	25	1.07	27	.15	3.8	1.33	34	0.5	0.7
1½	40	1.67	42	.15	3.8	1.93	49	0.9	1.3
2	50	2.10	53	.16	4.1	2.35	60	0.8	1.2
3	80	3.22	82	.16	4.1	3.50	89	1.2	1.8
4	100	4.14	105	.21	5.2	4.50	114	2.0	3.0
6	150	6.26	159	.22	5.4	6.64	169	3.1	4.6
8	200	8.22	209	.28	7.0	8.61	219	5.2	7.7
10	250	10.35	263	.34	8.6	10.95	278	8.1	12
12	300	12.35	314	.40	10.2	13.05	331	11	17
14	350	13.29	338	.43	11.0	14.04	357	13	19
		14.12**	359	.46	11.6	14.92	379	15	22
16	400	15.19	386	.49	12.5	16.05	408	17	25
		16.03**	407	.51	13.1	16.92	430	19	28
18	450	17.08	434	.55	13.9	18.04	458	21	32
		17.94**	456	.57	14.5	18.94	481	23	35
20	500	18.98	482	.60	15.4	20.03	509	26	39
		19.88**	505	.63	16.0	20.98	533	29	43
22	550	21.78**	553	.69	17.5	22.98	584	33	49
24	600	22.78	579	.72	18.3	24.04	611	37	56
		23.73**	603	.75	19.2	25.04	636	40	60
26	650	25.59**	650	.81	20.6	27.00	686	44	66
28	700	27.57**	700	.87	22.1	29.09	739	51	75
30	750	28.47	723	.89	22.6	30.00	762	58	86
		29.53**	750	.93	23.5	31.15	791	62	93
32	800	31.46**	799	.99	25.1	33.21	844	68	102
36	900	34.17	868	1.07	27.3	36.06	916	83	123
		35.31**	897	1.10	28.2	37.23	946	88	132
40	1000	39.37**	1000	1.17	29.7	41.41	1052	110	165

* Outside diameters of Series 7000M pipe in 250 and 300 mm sizes exceed iron pipe dimensions of ISO 559-1977 (273 and 324 mm, respectively) and cast iron pipe dimensions of ISO 13-1978 (274 and 326 mm, respectively).

Joining systems

1 to 16-inch (25 to 400 mm)

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

2 to 24-inch (50 to 600 mm)

Van Stone type flanges with movable flange rings for easy bolt alignment

1 to 40-inch (25 to 1000 mm)

One-piece flanges in standard hubbed or heavy-duty hubless configuration

2 to 40-inch (50 to 1000 mm)

Viking-Johnson or Dresser type mechanical couplings as per supplier's specification

Standard Bondstrand Series 7000M pipe is shipped in the configurations shown below. Pipe in 10-inch (250 mm) sizes and larger is shipped with plain spigot end to facilitate the use of mechanical couplings.

Nominal Pipe Size		Standard End Configuration
(in)	(mm)	
1 - 1½	25 - 40	Quick-Lock bell x plain end
2 - 8	50 - 200	Quick-Lock bell x shaved spigot
10 - 16	250 - 400	Quick-Lock bell x plain end
18 - 40	450 - 1000	plain end x plain end

Support spacing

Recommended maximum support spacing for Bondstrand Series 7000M pipe when carrying liquid with a specific gravity of 1.0.

Nominal Pipe Size		Temperature (°F/°C)							
		(100/38)		(150/66)		(200/93)		(250/121)	
(in)	(mm)	(ft)	(m)	(ft)	(m)	(ft)	(m)	(ft)	(m)
1	25	9.2	2.80	8.7	2.65	8.1	2.45	7.3	2.20
1½	50	10.3	3.15	9.8	3.00	9.1	2.75	8.2	2.50
2	50	11.8	3.60	11.2	3.40	10.4	3.15	9.4	2.85
3	80	13.4	4.10	12.7	3.85	11.8	3.60	10.7	3.25
4	100	15.2	4.65	14.4	4.40	13.4	4.10	12.1	3.70
6	150	17.4	5.30	16.5	5.05	15.3	4.65	13.9	4.25
8	200	19.6	5.95	18.6	5.65	17.3	5.25	15.6	4.75
10	250	22.1	6.75	20.9	6.35	19.4	5.90	17.5	5.35
12	300	24.1	7.35	22.8	6.95	21.2	6.45	19.1	5.80
14	350	24.9	7.60	23.6	7.20	23.2	7.05	19.8	6.05
16	400	26.8	8.15	25.3	7.70	23.6	7.20	21.3	6.50
18	450	28.3	8.65	26.7	8.15	24.9	7.60	22.5	6.85
20	500	29.8	9.10	28.2	8.60	26.2	8.00	23.7	7.20
22	550	31.7	9.65	30.0	9.15	27.9	8.50	25.2	7.70
24	600	32.5	9.90	30.7	9.35	28.6	8.70	25.8	7.85
26	650	34.4	10.50	32.6	9.95	30.3	9.25	27.4	8.35
28	700	35.8	10.90	33.8	10.30	31.5	9.60	28.4	8.65
30	750	36.2	11.05	34.3	10.45	31.9	9.70	28.8	8.80
32	800	37.5	11.45	35.0	10.65	32.6	9.95	30.1	9.15
36	900	37.8	11.50	35.8	10.90	33.3	10.15	31.0	9.45
40	1000	40.0	12.20	38.1	11.60	35.4	10.80	32.0	9.75

External pressure rating

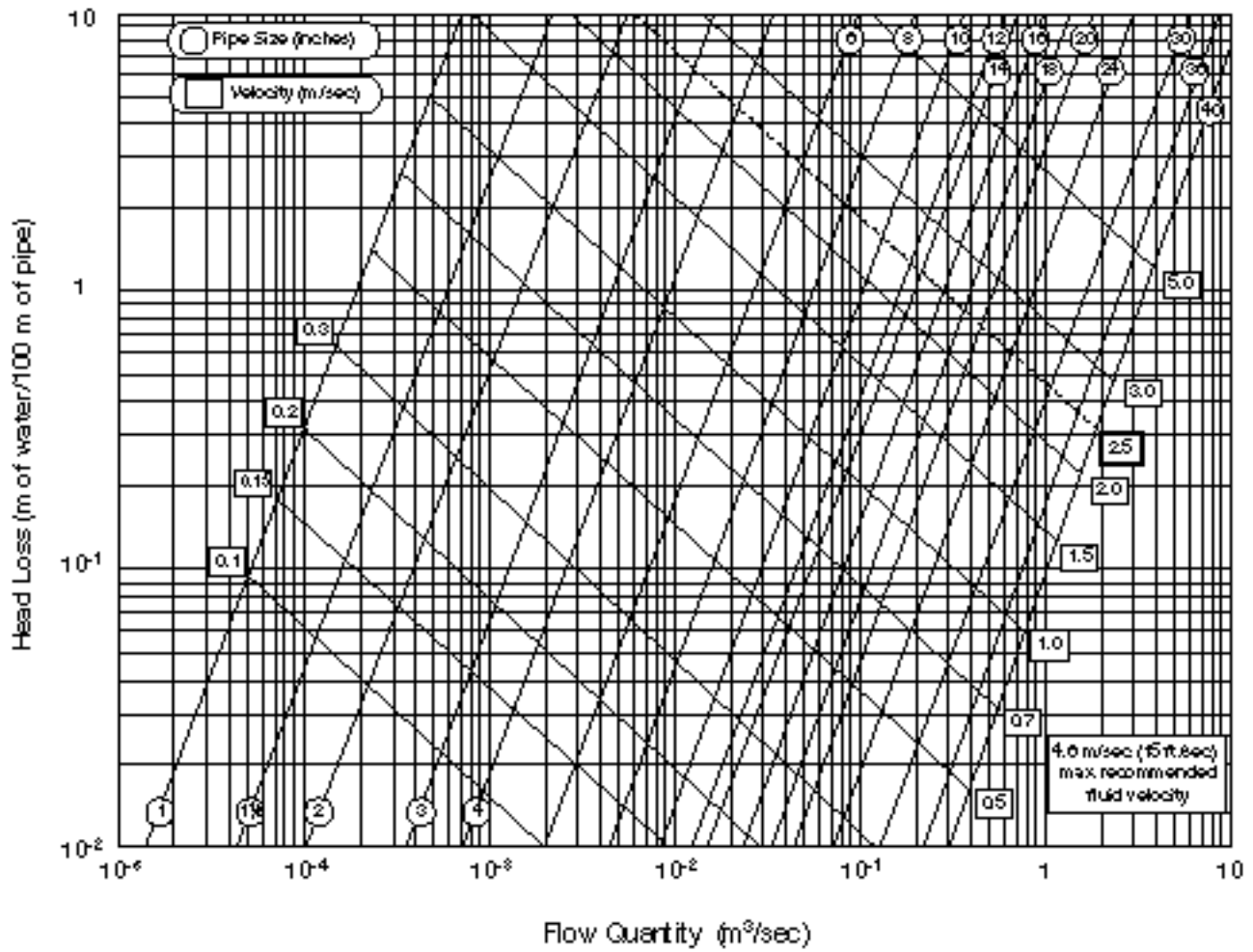
Collapse pressure calculations are based on minimum wall thicknesses (87½% of nominal wall thickness) and assume no contribution of strength by the liner. Maximum head calculations assume a 3:1 safety factor and 75% vacuum inside the pipe. For full vacuum conditions, subtract an additional 8.5 feet (2.6 m) from the tabulated values.

Nominal Pipe Size		100°F				150°F			
		Collapse Pressure		Maximum Head		Collapse Pressure		Maximum Head	
(in)	(mm)	(psi)	(bar)	(ft)	(m)	(psi)	(bar)	(ft)	(m)
1	25	>5000	>350	>5000	>1500	>5000	>350	>5000	>1500
1½	40	>5000	>350	>5000	>1500	>5000	>350	>5000	>1500
2	50	1457	100.5	1097	334.3	1412	97.4	1062	323.7
3	80	404	27.9	285	86.9	391	27.0	276	84.1
4	100	483	33.3	346	105.5	468	32.2	335	102.1
6	150	163	11.2	100	30.5	158	10.9	96	29.3
8	200	142	9.8	84	25.6	137	9.4	80	24.3
10	250	150	10.3	90	27.4	145	10.0	87	26.5
12	300	149	10.3	89	27.1	144	9.9	85	25.9
14	350	150	10.3	90	27.4	145	10.0	86	26.2
		155**	10.7	94	28.7	150	10.3	90	27.4
16	400	152	10.5	91	27.7	147	10.1	88	26.8
		146**	10.1	87	26.5	142	9.8	84	25.6
18	450	153	10.5	93	28.3	149	10.3	89	27.1
		148**	10.2	88	26.8	143	9.9	85	25.9
20	500	154	10.6	93	28.3	150	10.3	90	27.4
		149**	10.3	89	27.1	144	9.9	85	25.9
22	550	150**	10.3	90	27.4	145	10.0	86	26.2
24	600	150	10.3	90	27.4	145	10.0	86	26.2
		150**	10.3	90	27.4	145	10.0	87	26.5
26	650	151**	10.4	91	27.7	146	10.1	87	26.5
28	700	151**	10.4	91	27.7	147	10.1	87	26.5
30	750	147	10.1	88	26.8	143	9.9	85	25.9
		151**	10.4	91	27.7	147	10.1	87	26.5
32	800	152**	10.5	91	27.7	147	10.1	88	26.8
36	900	150	10.3	90	27.4	146	10.1	87	26.5
		152**	10.5	92	28.0	148	10.2	88	26.8
40	1000	129**	8.9	74	22.6	125	8.6	71	21.6

** Data for MCI pipe.

Head loss through Series 7000M pipe

The following chart provides head loss as a function of flow rate of water through Bondstrand Series 7000M piping. Values are based on the Hazen-Williams equation.



Technical support

Consult Ameron for further recommendations concerning the shipboard or offshore use of Bondstrand pipe system. For particular questions regarding the installation and use of Bondstrand Series 7000M antistatic pipe and fittings, refer to the Ameron Marine Engineering Manual.

Conversions

1 psi = 6895 Pa = 0.07031 kg/cm²
1 bar = 10⁵ Pa = 14.5 psi = 1.02 kg/cm²
1 MPa = 10⁶ Pa = 145 psi = 10.2 kg/cm²
1 GPa = 10⁹ Pa = 145,000 psi = 10,200 kg/cm²
1 in = 25.4 mm
1 ft = 0.3048 m
1 lb·in = 0.113 N·m
1 in⁴ = 4.162 x 10⁻⁷m⁴
1 ft/sec = 0.304 m/sec
1 gpm = 6.31 x 10⁻⁷ m³/sec
°C = $\frac{5}{9}$ (°F - 32)

Important Notice

This literature and the information and recommendations it contains are based on data reasonably believed to be reliable. However, such factors as variations in environment, application or installation, changes in operating procedures, or extrapolation of data may cause different results. Ameron makes no representation or warranty, express or implied, including warranties of merchantability or fitness for purpose, as to the accuracy, adequacy or completeness of the recommendations or information contained herein. Ameron assumes no liability whatsoever in connection with this literature or the information or recommendations it contains. Product specifications are subject to change.

Written comments regarding this document are invited. Please write Engineering Manager, Ameron Fiberglass Pipe Division.



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