

Bondstrand™ 2400 Series Product Data

Glassfiber Reinforced Epoxy (GRE) pipe systems

Applications

- Potable Water
- Cooling Water
- Produced Water
- Fire Water (FM Approved)
- Waste Water
- Salt Water
- Crude Oil & Gas
- Brine Solutions
- Drainage
- Sewage
- CO₂
- General Service for Mildly Corrosive Liquids

Materials and Characteristics

Filament wound Glassfiber Reinforced epoxy (GRE) pipe with an integral Taper female x shaved spigot adhesive bonded joint or Key-Lock integral female x male mechanical joint.

- Laminate meets requirements of API Specification 15LR and ISO 14692
- Pipe wall design based on hydrostatic design basis (Procedure B) with a 0.5 service factor
- Maximum operating temperature: 200°F (93°C). Temperatures up to 250°F (121°C) are possible. Please consult NOV Fiber Glass Systems
- Pipe sizes: 2 - 40 inch (50 - 1000 mm)
- Standard pressure rating up to 725 psi (50 bar). Higher pressure ratings are possible. Please consult NOV Fiber Glass Systems.
- ASTM D-2310 classification: RTRP-11AW for conductive pipe and RTRP-11FW for non-conductive pipe.
- Non-conductive pipe has a standard liner thickness of 0.5 mm. Conductive pipe has no liner.

Joining Systems

Fittings

Filament wound Glassfiber Reinforced epoxy (GRE) fittings with integral taper female bell ends. A wide range of fittings is available.

Flanges

Filament wound GRE heavy duty and stub end flanges with integral taper female bell end are available. Standard flange drilling pattern per ASME B16.5 and B16.47A, Class 150 are available. Other drilling patterns, such as Class 300, DIN and JIS are available.

For dimensional data and standard configurations for fittings, refer to the respective fitting guides. Optionally, the system can be supplied conductive (Bondstrand 2400C) or with fireproofing (Bondstrand 2400FP).

Pipe Lengths

From 2 - 6 inch (50 - 150 mm) 9 m random length
From 8 - 40 inch (200 - 1000 mm) 11.89 m random length

Note: Overall pipe length depends on size, end configuration and production location.

Total Wall Thickness

Pipe Size		Pressure Class (bar)								
inch	mm	2410	2412	2414	2416	2420	2425	2432	2440	2450
2	50	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.8	3.3
3	80	2.3	2.3	2.3	2.3	2.3	2.7	3.1	3.9	4.7
4	100	2.3	2.3	2.3	2.5	2.7	3.3	3.9	4.9	5.9
6	150	2.5	2.7	3.0	3.4	3.8	4.6	5.6	7.0	8.7
8	200	3.1	3.2	3.7	4.2	4.8	5.8	7.2	9.1	11.2
10	250	3.5	3.9	4.5	5.1	5.8	7.2	8.8	11.2	13.8
12	300	3.9	4.5	5.3	6.0	6.8	8.4	10.4	13.4	16.6
14	350	4.1	4.8	5.7	6.6	7.4	9.2	11.4	14.5	18.2
16	400	4.5	5.5	6.4	7.4	8.4	10.5	12.9	15.6	
18	450	4.9	6.0	7.0	8.1	9.2	11.5	14.2	18.2	
20	500	5.4	6.6	7.7	8.9	10.1	12.7	15.7	20.1	
24	600	6.3	7.7	9.3	10.6	12.1	15.1	18.8	24.0	
28	700	7.4	9.1	10.8	12.6	14.3	17.9	22.3		
30	750	7.9	9.7	11.6	13.5	15.3	19.1	23.9		
32	800	8.4	10.3	12.3	14.3	16.3	20.4	25.5		
36	900	9.3	11.5	13.7	16.1	18.2	22.8	28.5		
40	1000	10.3	12.8	15.3	17.8	20.3	24.8			

Note: (1) Pipe wall thickness measured according to NOV Fiber Glass Systems' procedure.
 (2) Total pipe wall thickness includes 0.5 mm liner for non-conductive pipe.

External Pressure (Ultimate Collapse Pressure at 21°C / 70°F)

Pipe Size		Pressure Class (bar)								
inch	mm	2410	2412	2414	2416	2420	2425	2432	2440	2450
2	50	18.6	18.6	18.6	18.6	18.6	18.6	18.6	37.7	66.3
3	80	5.3	5.3	5.3	5.3	5.3	9.5	15.5	33.7	61.7
4	100	2.5	2.5	2.5	3.4	4.6	9.2	16.3	34.3	61.7
6	150	1.0	1.3	2.0	3.0	4.5	8.4	15.9	32.1	62.5
8	200	1.0	1.1	1.8	2.8	4.4	8.0	15.9	32.8	61.4
10	250	0.8	1.1	1.8	2.7	4.1	8.1	15.2	31.7	61.8
12	300	0.7	1.1	1.8	2.7	4.0	7.9	15.2	32.7	61.7
14	350	0.6	1.0	1.7	2.8	4.0	7.9	15.3	32.2	61.9
16	400	0.5	1.0	1.7	2.7	4.0	8.1	15.1	26.7	
18	450	0.5	1.0	1.7	2.7	4.0	8.0	15.2	31.9	
20	500	0.5	1.0	1.7	2.7	3.9	8.0	15.1	31.6	
24	600	0.5	1.0	1.8	2.7	4.0	7.9	15.3		
28	700	0.5	0.9	1.6	2.6	3.8	7.6	14.6		
30	750	0.5	0.9	1.6	2.6	3.8	7.5	14.7		
32	800	0.5	0.9	1.6	2.6	3.9	7.6	14.7		
36	900	0.5	0.9	1.6	2.6	3.8	7.5	14.6		
40	1000	0.5	1.0	1.6	2.6	3.9	7.5			

Typical Mechanical Properties

Pipe Property	Units	Value 21°C	Value 93°C	Method
Hydrostatic Design Basis	N/mm ²	161 ⁽¹⁾	121	ASTM D2992, Proc. B (20 years)
Ultimate Hoop Stress at Weeping	N/mm ²	280	334	ASTM D1599
Circumferential				
Hoop Tensile Strength	N/mm ²	380	-	ASTM D2290
Hoop Tensile Modulus	N/mm ²	26700	16300	ASTM D2290
Poisson's Ratio ν_{ha} ⁽²⁾	-	0.61	0.80	NOV FGS
Longitudinal				
Axial Tensile Strength	N/mm ²	80	65	ASTM D2105
Axial Strength Modulus	N/mm ²	15500	8550	ASTM D2105
Poisson's Ratio ν_{ah} ⁽³⁾	-	0.35	0.42	ASTM D2105
Axial Bending Strength	N/mm ²	85	-	NOV FGS
Axial Bending Modulus	N/mm ²	15500	9900	ASTM D2925
Shear Modulus	N/mm ²	12100	11500	NOV FGS

Typical Physical Properties

Pipe Property	Units	Value	Method
Thermal Conductivity Pipe Wall	W/m°C	0.33	NOV FGS
Thermal Expansion @ 21°C	mm/mm°C	18 x 10 ⁻⁶	ASTM D696
Thermal Expansion @ 93°C	mm/mm°C	24 x 10 ⁻⁶	ASTM D696
Flow Efficient, Hazen Williams	-	150	-
Absolute Roughness	m	5.3 x 10 ⁻⁶	-
Density	kg/m ³	1800	-
Specific Gravity	-	1.8	ASTM D792
Specific Heat	J/kg°C	910	-
Grounding Resistance @ 500 Volt-Pipe	Ohm/m	<1 x 10 ⁻⁶	ASTM D257
Grounding Resistance @ 500 Volt-Ftg.	Ohm/ea	<1 x 10 ⁻⁶	ASTM D257
Shielding Capability	Volt	100	-

(1) value obtained at 65°C

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

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

Stiffness Factor per ASTM D2412 @21°C (@70°F)

Pipe Size		Pressure Class (bar)								
inch	mm	2410 lb/in	2412 lb/in	2414 lb/in	2416 lb/in	2420 lb/in	2425 lb/in	2432 lb/in	2440 lb/in	2450 lb/in
2	50	114	114	114	114	114	114	114	238	429
3	80	114	114	114	114	114	208	344	768	1448
4	100	114	114	114	156	208	429	768	1665	3078
6	150	156	208	305	477	702	1347	2593	5368	10777
8	200	344	385	640	990	1554	2910	5879	12432	23944
10	250	528	768	1251	1902	2910	5879	11176	23944	48089
12	300	768	1251	2162	3252	4887	9637	18965	41958	81568
14	350	912	1554	2748	4436	6421	12871	25312	54790	108384
16	400	1251	2443	4014	6421	9637	19545	37266	67294	
18	450	1665	3252	5368	8580	12871	26015	50258	108384	
20	500	2299	4436	7295	11585	17293	35491	68640	147168	
24	600	3814	7295	13320	20138	30508	60828	119784		
28	700	6421	12432	21358	34626	51367	102966	202495		
30	750	7920	15220	26731	42941	63362	125772	250433		
32	800	9537	18396	32114	51367	77093	154029	305397		
36	900	13320	26015	44954	72785	108384	216750	429060		
40	1000	17612	36371	63362	101200	151719	301810			

Pipe Stiffness per ASTM D2412 @21°C (@70°F)

Pipe Size		Pressure Class (bar)								
inch	mm	2410 psi	2412 psi	2414 psi	2416 psi	2420 psi	2425 psi	2432 psi	2440 psi	2450 psi
2	50	602.8	602.8	602.8	602.8	602.8	602.8	602.8	1223.8	2149.5
3	80	171.6	171.6	171.6	171.6	171.6	308.9	502.7	1092.8	2003.0
4	100	81.9	81.9	81.9	111.7	147.8	299.7	527.7	1112.6	2001.4
6	150	33.0	43.7	63.8	98.8	144.5	273.2	516.2	1041.8	2028.4
8	200	32.0	35.8	59.1	90.8	141.3	260.9	516.8	1064.5	1991.9
10	250	24.7	35.8	57.9	87.4	132.7	263.9	492.9	1028.6	2003.6
12	300	21.2	34.3	58.9	88.0	131.2	254.9	492.4	1059.6	2000.5
14	350	19.0	32.2	56.6	90.6	130.3	257.2	496.5	1046.2	2008.4
16	400	17.5	33.9	55.3	87.9	130.9	261.4	489.5	866.6	
18	450	17.4	33.7	55.3	87.8	130.7	260.1	493.4	1036.0	
20	500	17.5	33.5	54.8	86.4	128.0	258.5	491.0	1025.3	
24	600	16.8	31.9	57.8	86.8	130.6	256.4	495.5		
28	700	16.0	30.7	52.4	84.4	124.3	245.4	473.7		
30	750	16.0	30.6	53.3	85.1	124.6	243.7	476.3		
32	800	16.1	30.5	52.8	83.9	124.9	245.9	478.5		
36	900	15.6	30.3	51.9	83.5	123.4	243.1	472.3		
40	1000	15.7	30.8	53.3	84.6	125.9	244.2			

Single Span Lengths

Pipe Size		Pressure Class (bar)								
inch	mm	2410 m	2412 m	2414 m	2416 m	2420 m	2425 m	2432 m	2440 m	2450 m
2	50	2.8	2.8	2.8	2.8	2.8	2.8	2.8	3.0	3.1
3	80	3.2	3.2	3.2	3.2	3.2	3.3	3.5	3.7	3.9
4	100	3.4	3.4	3.4	3.5	3.6	3.8	4.0	4.2	4.4
6	150	3.9	4.0	4.1	4.3	4.4	4.6	4.9	5.1	5.4
8	200	4.5	4.4	4.7	4.9	5.0	5.3	5.6	5.9	6.2
10	250	4.7	4.9	5.3	5.4	5.6	6.9	6.2	6.6	6.9
12	300	4.9	5.3	5.7	5.9	6.1	6.5	6.8	7.2	7.6
14	350	5.0	5.4	6.0	6.2	6.4	6.8	7.1	7.5	7.9
16	400	5.2	5.9	6.4	6.6	6.9	7.2	7.6	7.9	
18	450	5.4	6.2	6.7	7.0	7.2	7.6	8.0	8.5	
20	500	5.8	6.5	7.1	7.3	7.6	8.0	8.4	8.9	
24	600	6.2	7.0	7.8	8.1	8.3	8.8	9.2	9.8	
28	700	6.7	7.6	8.4	8.8	9.1	9.6	10.1		
30	750	7.0	7.9	8.7	9.2	9.4	9.9	10.5		
32	800	7.2	8.1	9.0	9.4	9.7	10.3	10.8		
36	900	7.6	8.6	9.5	10.0	10.3	10.9	11.5		
40	1000	8.0	9.1	10.1	10.6	10.9	11.4			

Continuous Span Lengths

Pipe Size		Pressure Class (bar)								
inch	mm	2410 m	2412 m	2414 m	2416 m	2420 m	2425 m	2432 m	2440 m	2450 m
2	50	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.5	4.7
3	80	4.8	4.8	4.8	4.8	4.8	5.0	5.2	5.5	5.8
4	100	5.1	5.1	5.1	5.2	5.4	5.7	5.9	6.3	6.5
6	150	5.8	6.0	6.2	6.4	6.6	6.9	7.3	7.7	8.1
8	200	6.7	6.7	7.0	7.3	7.5	7.9	8.3	8.8	9.2
10	250	7.3	7.6	7.9	8.1	8.4	8.9	9.3	9.8	10.3
12	300	7.9	8.2	8.6	8.9	9.2	9.7	10.2	10.8	11.3
14	350	8.2	8.6	9.0	9.3	9.6	10.1	10.7	11.3	11.8
16	400	8.7	9.2	9.6	9.9	10.3	10.8	11.4	11.9	
18	450	9.2	9.7	10.1	10.4	10.8	11.4	11.9	12.6	
20	500	9.7	10.2	10.6	11.0	11.3	12.0	12.6	13.3	
24	600	10.6	11.1	11.7	12.0	12.4	13.1	13.8	14.6	
28	700	11.6	12.2	12.7	13.2	13.6	14.4	15.1		
30	750	12.0	12.6	13.2	13.7	14.1	14.9	15.7		
32	800	12.4	13.0	13.6	14.1	14.6	15.4	16.2		
36	900	13.1	13.8	14.4	15.0	15.4	16.3	17.2		
40	1000	13.8	14.6	15.2	15.8	16.3	17.2			

Note: Span lengths are at 21°C (70°F).

*National Oilwell Varco has produced this brochure for general information only, and it is not intended for design purposes. Although every effort has been made to maintain the accuracy and reliability of its contents, National Oilwell Varco in no way assumes responsibility for liability for any loss, damage or injury resulting from the use of information and data herein. All applications for the material described are at the user's risk and are the user's responsibility.
All brands listed are trademarks of National Oilwell Varco.*

North America

17115 San Pedro Avenue
Suite 200
San Antonio, TX 78232 USA
Phone: +1 210 477 7500

South America

Estrada de Acesso à 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

www.fgspipe.com • fgspipe@nov.com

The logo for NOV Fiber Glass Systems features the letters 'NOV' in a stylized, bold font with a red and white circular graphic element to the left of the 'V'. To the right of 'NOV', the words 'Fiber Glass Systems' are written in a blue, sans-serif font.

© 2013 National Oilwell Varco. All rights reserved.
CI2400ENG - June 2014