Centricast RB-1520™ Product Data

Applications

- Dilute Acids
- Caustics
- Salts
- Solvents
- Chemical Process Solutions

Materials and Construction

All pipe is manufactured with high strength glass fabrics and a highly resilient formulation of aromatic amine cured epoxy resin. A 50-mil integral corrosion barrier of pure resin provides excellent corrosion resistance. The pipe's proprietary resin formulation provides the toughness for many corrosive slurries. A 10-mil resin-rich reinforced external corrosion barrier provides excellent corrosion resistance and protection from ultraviolet (UV) radiation. Fiber Glass Systems warrants CENTRICAST RB-1520 pipe and fittings against UV degradation of physical properties and chemical resistance for 15 years.

Pipe is available in **1½" through 14"** diameters with pressure ratings up to 150 psig at a maximum operating temperature of 225°F. **Centricast RB-1520** comes in 20' nominal or exact lengths from 18.0-20.4 feet long.

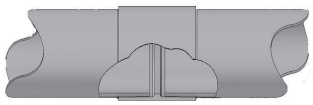
Fittings

Fittings are manufactured with the same **chemical/temperature** capabilities as the pipe. Depending on the particular part and size, fittings will be compression molded, contact molded, hand fabricated or filament wound.

Joining Systems

Socket Joint

Adhesive bonded straight socket joint with positive stops. This is the standard for Centricast piping systems.



Nominal Dimensional Data

Pipe Size (In)	I.D.		O.D.		Wall Thickness		Reinforcement Thickness		Weight		Capacity	
	(In)	(mm)	(In)	(mm)	(In)	(mm)	(In)	(mm)	(Lbs/Ft)	(kg/m)	(Gal/Ft)	(CuFt/Ft)
1½	1.55	39.4	1.90	48.3	0.18	4.4	0.12	2.9	0.58	0.86	0.10	0.013
2	2.06	52.2	2.38	60.3	0.16	4.1	0.10	2.5	0.68	1.01	0.17	0.023
3	3.18	80.8	3.50	88.9	0.16	4.1	0.10	2.5	1.03	1.53	0.41	0.055
4	4.18	106.2	4.50	114.0	0.16	4.1	0.10	2.5	1.34	1.99	0.71	0.095
6	6.27	159.0	6.63	168.0	0.18	4.6	0.12	3.0	2.23	3.32	1.60	0.214
8	8.23	209.0	8.63	219.0	0.20	5.1	0.14	3.6	3.24	4.82	2.76	0.369
10	10.30	262.0	10.75	273.0	0.22	5.6	0.16	4.1	4.45	6.63	4.34	0.580
12	12.30	312.0	12.75	324.0	0.24	6.1	0.18	4.6	5.77	8.59	6.14	0.821
14	13.50	343.0	14.00	356.0	0.24	6.1	0.18	4.6	6.35	9.45	7.46	0.997

Tolerances or maximum/minimum limits can be obtained from NOV Fiber Glass Systems.

Properties of Pipe Sections Based on Minimum Reinforced Walls

Size (In)	Reinforcement End Area (In^2)	Reinforcement Moment of Inertia (In^4)	Reinforcement Section Modulus (In^3)	Nominal Wall End Area (In^2)
1 1/2	0.67	0.27	0.28	0.97
2	0.71	0.46	0.39	1.11
3	1.07	1.54	0.88	1.68
4	1.38	3.35	1.49	2.18
6	2.45	13.00	3.92	3.64
8	3.73	33.60	7.79	5.29
10	5.32	74.60	13.90	7.28
12	7.11	140.00	22.00	9.43
14	7.82	187.00	26.70	10.40

Average Physical Properties

Property	75°F psi	24°C MPa	200°F psi	99°C MPa	225°F psi	107°C MPa
Axial Tensile - ASTM D2105						
Ultimate Stress	30,000	210	26,000	180	25,000	170
Design Stress	7,500	52	6,500	45	6,250	43
Modulus of Elasticity	$2.5x10^6$	17,200	$2.2x10^6$	15,200	$2.1x10^6$	14,500
Poisson's Ratio ν	0.15		0.15		0.15	
Axial Compression - ASTM D695						
Ultimate Stress	35,000	240	28,000	190	17,000	110
Design Stress	8,750	60	7,000	48	4,250	29
Modulus of Elasticity	$3.2x10^6$	22,000	$2.8x10^6$	19,300	$2.7x10^6$	18,600
Beam Bending - ASTM D2925						
Ultimate Stress	40,000	280	35,000	240	33,000	230
Design Stress[(1)]	5,000	34	4,375	30	4,125	28
Modulus of Elasticity (Long Term)	$3.7x10^6$	26,000	$3.2x10^6$	22,000	$3.1x10^6$	21,000
Hydrostatic Burst - ASTM D1599						
Ultimate Hoop Tensile Stress	30,000	210	26,000	180	25,000	170
Hoop Tensile Modulus of Elasticity	$2.4x10^6$	17,000	$2.1x10^6$	14,500	$2.0x10^6$	13,800
Hydrostatic Design - ASTM D2992, Procedure B - Hoop Tensile Stress Static 50 Year @ 75°F	19,270	130	-	-	-	-

[(1)] Stress and modulus values can be interpolated between temperatures shown.

Coefficient of Linear Thermal Expansion - ASTM D696	Non-Insulated Pipe: 9.6×10^{-6} in/in/°F • 17.4×10^{-6} mm/mm/°C Insulated Pipe: 13.0×10^{-6} in/in/°F • 23.5×10^{-6} mm/mm/°C
Thermal Conductivity	0.07 BTU/-hr-ft-°F • 0.04 W/-m-°C
Specific Gravity - ASTM D792	1.41
Flow Factor - SF / Hazen-Williams Coefficient	150
Absolute Surface Roughness	0.00021 Inch • 0.0053 mm
Manning's Roughness Coefficient, n	0.009

Testing:

See NOV FIber Glass Systems' **Socket Joint Installation Handbook.**

When possible, the piping system should be hydrostatically tested prior to beginning service. Care should be taken when testing to avoid water hammer. **All anchors, guides and supports must be in place prior to testing the line.**

Test pressure should not be more than 1½ times the working pressure of the piping system and never exceed 1½ times the rated operating pressure of the lowest rated component in the system.

Water Hammer:

Care should be taken when designing an FRP piping system to eliminate sudden surges. Soft start pumps and slow actuating valves should considered.

Pressure Ratings for Uninsulated Piping Systems[1][2]

Pipe Size (In)	Maximum Internal Pressure @ 225°F (psig)			Maximum External Pressure[6]		
	Socket Pressure Fittings[3]	Flanged Pressure Fittings[4]	Other Pressure Fittings[5]	75°F	150°F	225°F
1 1/2	300	150	NA	920	753	649
2	300	150	125	290	231	199
3	275	150	125	103	104	90
4	150	150	100	47	37	32
6	150	150	100	22	18	16
8	150	150	100	19	12	11
10	150	150	75	12	10	8
12	150	150	75	7	6	5
14	125	150	-	7	6	5

ASTM D2997 Designation Codes	
1½"- 4"	RTRP-21CW-4556
6"	RTRP-21CW-4555
8"	RTRP-21CW-4554
10"-12"	RTRP-21CW-4553
14"	RTRP-21CW-4552

(1) Static pressure ratings, typically created with use of a gear pump, turbine pump, centrifugal pump, or multiplex pump having 4 or more pistons or elevation head.
(2) For insulated and/or heat traced piping systems, use 100% of the uninsulated piping recommendations up to 200°F and reduce these ratings 50% for 200°F to 225°F operating temperatures. **Centricast RB-1520** pipe and epoxy fittings can be used in drainage and vent systems up to 250°F operating temperatures. For compressible gasses consult the factory for pressure ratings. Heat cured adhesive joints are highly recommended for all piping systems carrying fluids at temperatures above 120°F.
(3) Socket elbows, tees, reducers, couplings, flanges and nipples joined with **WELDFAST ZC275** adhesive.
(4) Flanged elbows, tees, reducers, couplings and nipples assembled at factory.
(5) Laterals, crosses, and saddles.
(6) Ratings shown are 50% of ultimate; 14.7 psi external pressure is equal to full vacuum.

Recommended Operating Ratings

Size (In)	Axial Tensile Loads Max. (Lbs)		Axial Compressive Loads Max. (Lbs)[1]		Bending Radius Min. (Ft) Entire Temp. Range	Torque Max. (Ft Lbs) Entire Temp. Range	Parallel Plate Loading ASTM D2412		
	Temperature		Temperature				Stiffness Factor In^3 Lbs/In^2	Pipe Stiffness (psi)	Hoop Modulus $x10^6$ (psi)
	@ 75°F	@ 225°F	@ 75°F	@ 225°F					
1 1/2	5,000	4,100	5,800	2,800	59	113	279	2,632	2.2
2	5,400	4,500	6.300	3,000	73	163	317	1,444	3.8
3	8,000	6,700	9,300	4,500	108	368	317	433	3.8
4	10,400	8,600	12,100	5,900	139	620	317	200	3.8
6	18,400	15,300	21,500	10,400	204	1,632	547	107	3.8
8	28,000	23,300	32,700	15,900	266	3,246	709	62	3.1
10	39,900	33,300	46,600	22,600	331	5,786	1,195	54	3.5
12	53,300	44,400	62,200	30,200	393	9,178	1,701	46	3.5
14	58,600	48,800	68,400	33,200	432	11,108	1,701	35	3.5

(1) Compressive loads are for short columns only. Buckling loads must be calculated when applicable.

Support

Proper pipe support spacing depends on the temperature and weight of the fluid in the pipe. The support spacing table is based on unrestrained continuous beam theory using the pipe bending modulus derived from long-term beam bending tests. The maximum spans lengths were developed to ensure a design that limits mid-span deflection to ½ inch and dead weight bending to 1/8 of the ultimate bending stress. Any additional loads on the piping system such as insulation, wind, seismic, etc. requires further consideration. Restrained (anchored) piping systems operating at elevated temperatures may result in guide spacing requirements that are shorter than unrestrained piping systems. In this case, the maximum guide spacing governs the support span requirements for the system. Pipe spans near elbows require special attention. Both supported and unsupported elbows are considered in the following tables and must be followed to properly design the piping system.

There are seven basic rules to follow when designing piping system supports:

1. Do not exceed the recommended support span.
2. Support heavy valves and in-line equipment independently.
3. Protect pipe from external abrasion at supports.
4. Avoid point contact loads.
5. Avoid excessive bending. This applies to handling, transporting, initial layout, and final installed position.
6. Avoid excessive vertical loading to minimize bending stress on pipe and fittings.
7. Provide adequate axial and lateral restraint to ensure line stability during rapid changes in flow.

Maximum Support Spacing for Uninsulated Pipe[1]

Pipe Size (In.)	Continuous Spans of Pipe (Ft.)[2]		
	75°F	150°F	225°F
1½	16.6	16.0	15.9
2	17.3	16.7	16.6
3	19.4	18.7	18.6
4	20.9	20.1	20.0
6	24.2	23.3	23.2
8	26.9	26.0	25.8
10	29.5	28.4	28.2
12	31.7	30.6	30.4
14	32.5	31.4	31.4

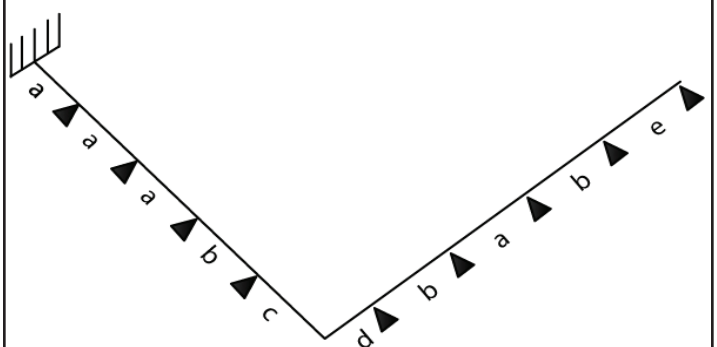
[1]Consult factory for insulated pipe support spacing.
[2]Maximum mid-span deflection ½" with a specific gravity of 1.0.

Support Spacing vs. Specific Gravity							
Specific Gravity	3.00	2.00	1.50	1.25	1.00	0.75	Gas/Air
Multiplier	0.76	0.84	0.90	0.95	1.00	1.07	1.40

Example: 6" pipe @ 150°F with 1.5 specific gravity fluid,maximum support spacing = 23.9 x 0.90 = 21.5 ft.

Piping Span Adjustment Factors With Unsupported Fitting at Change in Direction

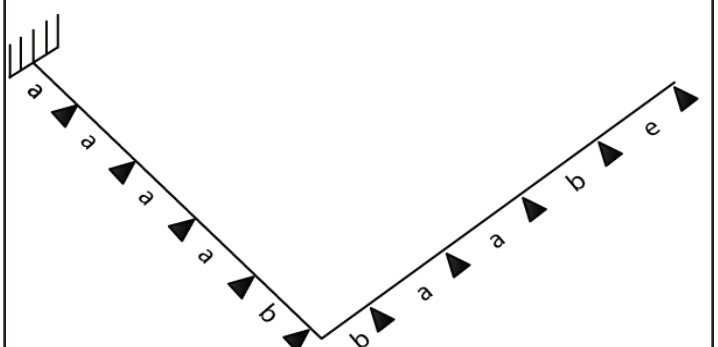
	Span Type	Factor
a	Continuous interior or fixed end spans	1.00
b	Second span from simple supported end or unsupported fitting	0.80
c + d	Sum of unsupported spans at fitting	≤ 0.75*
e	Simple supported end span	0.67



** For example: If continuous support span is 10 ft., c + d must not exceed 7.5 ft. (c = 3 ft. and d = 4.5 ft. would satisfy this condition).*

Piping Span Adjustment Factors With Supported Fitting at Change in Direction

	Span Type	Factor
a	Continuous interior or fixed end spans	1.00
b	Span at supported fitting or span adjacent to a simple supported end	0.80
e	Simple supported end span	0.67



Thermal Expansion

The effects of thermal gradients on piping systems may be significant and should be considered in every piping system stress analysis. Pipe line movements due to thermal expansion or contraction may cause high stresses or even buckle a pipe line if improperly restrained. Several piping system designs are used to manage thermal expansion and contraction in above ground piping systems. They are listed below according to economic preference:

1. Use of inherent flexibility in directional changes
2. Restraining axial movements and guiding to prevent buckling
3. Use expansion loops to absorb thermal movements
4. Use mechanical expansion joints to absorb thermal movements

To perform a thermal analysis the following information is required:

1. Isometric layout of piping system
2. Physical and material properties of pipe
3. Design temperatures
4. Installation temperature (final tie-in temperature)
5. Terminal equipment load limits
6. Support movements

A comprehensive review of temperature effects on fiberglass pipe may be found in Fiber Glass Systems' **Engineering and Piping Design Guide.**

Change in Temperature °F	Pipe Change In Length (In/100 Ft)
25	0.29
50	0.58
75	0.86
100	1.15
125	1.44
150	1.73
175	2.02
200	2.30

Restrained Thermal End Loads and Guide Spacing

Size (In)	Operating Temperature °F (Based on Installation Temperature of 75°F)									
	125		150		175		200		225	
	Guide Spacing (Ft)	Thermal End Load (Lbs)	Guide Spacing (Ft)	Thermal End Load (Lbs)	Guide Spacing (Ft)	Thermal End Load (Lbs)	Guide Spacing (Ft)	Thermal End Load (Lbs)	Guide Spacing (Ft)	Thermal End Loads (Lbs)
1½	8.2	982	6.6	1,440	5.6	1,862	4.9	2,255	4.4	2,609
2	10.5	1,046	8.4	1,533	7.1	1,983	6.2	2,401	5.6	2,779
3	15.6	1,564	12.6	2,292	10.6	2,963	9.3	3,589	8.4	4,153
4	20.2	2,024	16.3	2,966	13.8	3,835	12.0	4,645	10.8	5,374
6	29.9	3,590	24.0	5,262	20.4	6,804	17.8	8,240	16.0	9,535
8	39.0	5,463	31.4	8,007	26.6	10,354	23.2	12,539	20.9	14,510
10	48.6	7,793	39.1	11,421	33.2	14,768	29.0	17,886	26.0	20,696
12	57.7	10,406	46.5	15,251	39.4	19,721	34.4	23,883	30.9	27,637
14	63.4	11,441	51.1	16,768	43.3	21,682	37.8	26,528	34.0	30,385

Elbow Strength

Allowable Bending Moment 90° Elbow			
Nominal Pipe Size (In)	Allowable Moment (Ft•Lbs)	Nominal Pipe Size (In)	Allowable Moment (Ft•Lbs)
1½	150	8	2,850
2	225	10	4,500
3	475	12	6,500
4	650	14	10,000
6	1,650		

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