Centricast CL-1520® Product Data

Applications

- Acids
- Salts
- Oxidizing Agents
- Chlorine Water

Materials and Construction

All pipe is manufactured with glass fabrics and a highly resilient formulation of vinyl ester resin. A 50-mil integral corrosion barrier of pure resin provides excellent corrosion resistance. It is recommended for most chlorinated and/or acidic mixtures up to 175°F and other chemicals up to 200°F. A 10-mil resin-rich reinforced external corrosion barrier provides excellent corrosion resistance and protection from ultraviolet (UV) radiation. Fiber Glass Systems warrants Centricast CL-1520 pipe and fittings against UV degradation of physical properties and chemical resistance for 15 years.

Pipe is available in **1½" through 14"** diameters and is recommended for highly chlorinated or acidic mixtures up to 175°F and many other chemicals up to 200°F. **Centricast CL-1520** comes in 20' nominal or exact lengths from 18.0-20.4 feet long.

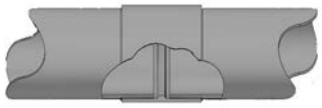
Fittings

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

An adhesive bonded socket connection with positive stops in the fittings is standard and simplifies close tolerance piping installation. This joining system is easy to install and no special tools are required for field assembly.



Nominal Dimensional Data

Pipe Size	I.D.		O.D.		Wall Thickness		Reinforcement Thickness		Weight		Capacity	
in	in	mm	in	mm	in	mm	in	mm	lbs/ft	kg/m	gal/ft	ft³/ft
1½	1.52	38.6	1.90	48.3	0.19	4.8	0.13	3.3	0.67	1.00	0.09	0.013
2	2.00	50.8	2.38	60.5	0.19	4.8	0.13	3.3	0.86	1.28	0.16	0.022
3	3.12	79.2	3.50	88.9	0.19	4.8	0.13	3.3	1.30	1.94	0.40	0.053
4	4.12	104.6	4.50	114.3	0.19	4.8	0.13	3.3	1.70	2.53	0.69	0.093
6	6.21	157.7	6.63	168.4	0.21	5.3	0.15	3.8	2.79	4.16	1.57	0.210
8	8.15	207.0	8.63	219.2	0.24	6.1	0.18	4.6	4.17	6.21	2.71	0.362
10	10.30	261.6	10.75	273.1	0.24	6.1	0.18	4.6	5.23	7.78	4.30	0.575
12	12.30	312.4	12.75	323.9	0.24	6.1	0.18	4.6	6.23	9.26	6.14	0.821
14	13.50	342.9	14.00	355.6	0.24	6.1	0.18	4.6	6.85	10.19	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
1½	0.72	0.29	0.30	1.02
2	0.92	0.58	0.49	1.30
3	1.38	1.96	1.12	1.98
4	1.79	4.26	1.90	2.57
6	3.05	16.00	4.83	4.23
8	4.78	42.60	9.88	6.32
10	5.98	83.50	15.50	7.92
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	150°F psi	66°C MPa	175°F psi	180°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	6,200	43
Modulus of Elasticity	2.6×10^6	17,900	2.3×10^6	15,900	2.2×10^6	15,200
Poisson's Ratio ν			0.15			
Axial Compression - ASTM D695						
Ultimate Stress	32,000	220	30,000	200	22,000	150
Design Stress	8,000	55	7,500	52	5,550	38
Modulus of Elasticity	3.1×10^6	21,400	2.7×10^6	18,600	2.6×10^6	17,900
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)	3.3×10^6	22,800	2.9×10^6	20,000	2.8×10^6	19,300
Hydrostatic Burst - ASTM D1599						
Ultimate Hoop Tensile Stress	30,000	200	26,000	180	25,000	170
Hoop Tensile Modulus of Elasticity	2.4×10^6	17,000	2.1×10^6	14,500	2.0×10^6	13,800
Hydrostatic Design - ASTM D2992						
Procedure B-Hoop Tensile Stress						
Static 50 Year @ 175°F	-	-	-	-	11,690	81

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

Thermal Expansion Coefficient - ASTM D696	Non-Insulated Pipe: 8.4×10^6 In/In/°F • 15.2×10^6 mm/mm/°C Insulated Pipe: 9.2×10^6 In/In/°F • 16.6×10^6 mm/mm/°C	
Thermal Conductivity	0.07 BTU/hr-ft-°F	0.04 W/m-°C
Specific Gravity - ASTM D792	1.52	
Hazen-Williams Coefficient	150	
Absolute Surface Roughness	0.00021 in	0.0053 mm
Manning's Roughness Coefficient, n	0.009	

Testing:

See Fiber Glass Systems' **Socket Joint Installation Handbook.**

When possible, Fiber Glass Systems' piping systems 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.

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

Nominal Pipe Size in	Maximum Internal Pressure @ 175°F psig			Maximum External Pressure psig[6]		
	Socket Pressure Fittings[3]	Flanged Pressure Fittings[4]	Other Pressure[5]	75°F	150°F	175°F
1½	300	300	-	650	579	491
2	275	200	125	380	268	227
3	200	150	125	130	74	63
4	150	150	100	50	33	28
6	150	150	100	30	21	17
8	150	150	100	25	17	14
10	150	150	75	16	13	11
12	150	150	75	10	8	7
14	125	150	-	7	5	4

ASTM D2997 Designation Codes:	
1½"-4"	RTRP-22BT-4556
6"	RTRP-22BT-4555
8"	RTRP-22BT-4554
10"-12"	RTRP-22BT-4553
14"	RTRP-22BT-4552

[1]Static pressure ratings, typically created with use of a gear turbine, centrifugal, or multiplex pump having 4 or more pistons or elevation head.

[2]Reduce pressure ratings by 30% for 175°F to 200°F operating temperatures. For compressible gases, insulated and/or heat traced piping systems, consult the factory for pressure ratings. **Centricast CL-1520** pipe and vinyl ester fittings can be used in drainage and vent systems up to 200°F. 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 CL-200** 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 75°F	175°F	Temperature 75°F	175°F			Stiffness Factor In^3 Lbs/In^2	Pipe Stiffness psi	Hoop Modulus x10^6 psi
1½	5,400	4,500	5,800	4,000	52	125	366	3,545	2.0
2	6,900	5,700	7,300	5,000	65	203	366	1,738	2.0
3	10,300	8,600	11,000	7,600	96	466	458	642	2.5
4	13,400	11,200	14,300	9,800	124	790	458	294	2.5
6	22,900	19,100	24,400	16,800	182	2,013	788	156	2.8
8	35,800	29,800	38,200	26,300	237	4,115	1,264	113	2.6
10	44,800	37,400	47,800	32,900	296	6,473	1,458	66	3.0
12	53,300	44,400	56,900	39,100	351	9,178	1,652	45	3.4
14	58,600	48,800	62,500	43,000	385	11,108	1,652	34	3.4

[1]Compressive loads are for short columns only.

Water Hammer:

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

Pipe Lengths Available*	
Size in	Random Length ft
1½-14	20
*Pipe comes in random or exact lengths from 18.0 - 20.4 feet long.	

Supports

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 stresses 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	175°F
1½	16.4	15.8	15.7
2	17.6	17.0	16.9
3	19.9	19.2	19.1
4	21.4	20.7	20.5
6	24.7	23.9	23.7
8	27.7	26.8	26.5
10	29.4	28.5	28.2
12	30.8	29.8	29.5
14	31.6	30.6	30.3

[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

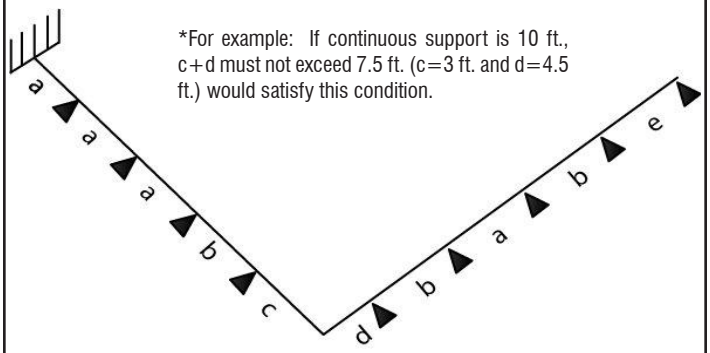
Specific Gravity	3.00	2.00	1.50	1.25	1.00	0.75	Gas/Air
Multiplier	0.76	0.84	0.90	0.95	1.00	1.07	1.40

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

Adjustment Factors for Various Spans With Unsupported Fitting at Change in Direction

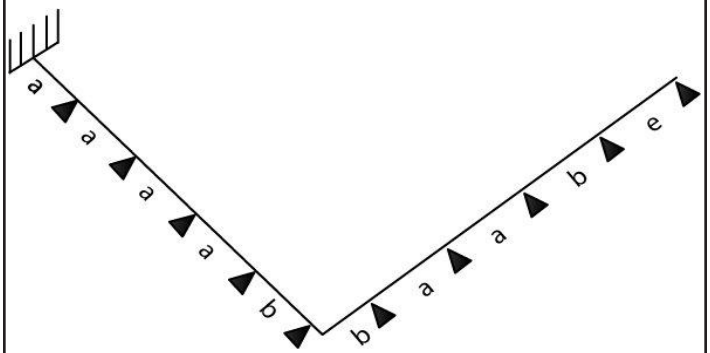
	Span Type	Factor
a	Continuous interior or fixed end spans	1.00
b	Second span from supported end or unsupported fitting	0.80
c+d	Sum of unsupported spans at fitting	≤0.75*
e	Simple supported end span	0.67

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



Adjustment Factors for Various Spans With Supported 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
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 NOV Fiber Glass Systems' **Engineering and Piping Design Guide.**

Change in Temperature °F	Pipe Change In Length in/100 Ft
25	0.25
50	0.50
75	0.76
100	1.01
125	1.26
150	1.51
175	1.76
200	2.02

Restrained Thermal End Loads and Guide Spacing

Size in	Operating Temperature °F (Based on Installation Temperature of 75°F)									
	100°F		125°F		150°F		175°F		200°F	
	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	11.2	492	7.9	938	6.5	1,347	5.6	1,729	5.0	1,663
2	14.2	624	10.0	1,189	8.2	1,708	7.1	2,193	6.3	2,109
3	21.2	937	15.0	1,785	12.3	2,564	10.6	3,292	9.5	3,166
4	27.5	1,215	19.5	2,315	15.9	3,325	13.8	4,269	12.3	4,105
6	40.8	2,077	28.8	3,958	23.5	5,685	20.4	7,299	18.2	7,018
8	53.2	3,251	37.6	6,195	30.7	8,897	26.6	11,423	23.8	10,984
10	66.6	4,069	47.1	7,754	38.4	11,136	33.3	14,297	29.8	13,748
12	79.2	4,839	56.0	9,221	45.7	13,243	39.6	17,003	35.4	16,349
14	87.0	5,320	61.5	10,138	50.2	14,559	43.5	18,694	38.9	17,975

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		

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
ISO 9001:2008
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SUZHOU, CHINA
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