

# Smith Fibercast CENTRICAST PLUS<sup>®</sup> CL-2030 Piping Systems



# CENTRICAST PLUS® CL-2030 Pipe

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## PRODUCT

CENTRICAST PLUS CL-2030 pipe is manufactured with high strength glass fabrics and a highly resilient formulation of corrosion resistant vinyl ester resin. A 100 mil integral corrosion barrier of pure resin provides excellent corrosion resistance. It is recommended for most highly chlorinated or acidic mixtures up to 175°F and many other chemical up to 200°F. Centricast Plus CL-2030 proprietary resin formulation also provides toughness for many corrosive types of slurries. Pipe and fittings are available in 1"-14" with static pressure ratings up to 150 psig, with higher pressure ratings in smaller sizes. CENTRICAST PLUS CL-2030 comes in 20' nominal or exact lengths.

## EXTERNAL BARRIER

A 10 mil resin-rich reinforced external corrosion barrier provides excellent corrosion resistance and protection

from ultraviolet (UV) radiation. CL-2030 also contains a UV inhibitor for protection against "fiber blooming" caused by UV radiation. Smith Fibercast warrants CENTRICAST PLUS CL-2030 pipe and fittings against UV degradation of physical properties and chemical resistance for 15 years.

## FITTINGS

Compatible vinyl ester fittings are manufactured with the same chemical resistance, temperature rating and performance capabilities as the pipe. The fabrication process is dependent on the fitting type and size. Fittings are manufactured by compression molding, contact molding or filament winding.

## JOINING METHODS

An adhesive bonded socket connection with positive stops in the fittings is standard design. The use of positive stops simplifies close tolerance piping installation. This joining system is easy to install and no special tools are required for field assembly. The joint is prepared for bonding by lightly sanding the pipe O.D. and the mating fitting's socket. A high strength adhesive with the same chemical resistance and temperature capabilities is used to bind the pipe and fittings. See Manual No. F6080 "Pipe Installation Handbook" for detailed installation instructions and fabrication techniques.

## RECOMMENDED SERVICES

CENTRICAST PLUS CL-2030 vinyl ester resin pipe is excellent for many chemical and slurry applications including strong acids, chlorine

and oxidizing agents that corrode traditional metal pipe. Refer to Manual No. E5615 "Chemical Resistance Guide" for proper application.

## BENEFITS

The excellent chemical resistance of CL-2030 piping system provides longer service life than traditional piping materials. CL-2030's performance conveying chemical mixtures and strong acids is particularly exceptional resulting in a reduction in maintenance and replacement costs.

CL-2030 piping systems are light weight and easily installed. Reductions in labor costs and heavy handling equipment due to the ease of installation result in lower total installed costs.

CL-2030 pipe typically weighs less than ¼ that of comparable Schedule 40 Stainless Steel. A 20' length of 4" CL-2030 weighs 58 lbs. while the same length of stainless steel weighs 216 lbs.

## DISTRIBUTION

FGS Smith Fibercast has a network of stocking distributors throughout the United States as well as representatives and distributors throughout the world. These distributors are supported by a staff of experienced application engineers and highly trained field service technicians strategically located around the world.



# CENTRICAST PLUS® CL-2030 Pipe

## PIPE PROPERTIES

### General Specifications and Dimensional Data\*

Nominal Pipe Size	Nominal I.D.		Nominal O.D.		Nominal Wall Thickness		Reinforcement Thickness		Nominal Weight		Capacity	
	(In.)	(mm)	(In.)	(mm)	(In.)	(mm)	(In.)	(mm)	(Lbs./Ft.)	(kg/m)	(Gal./Ft.)	(Cu. Ft./Ft.)
1	0.94	23.7	1.32	33.4	0.19	4.8	0.095	2.4	0.45	0.68	0.04	0.005
1 1/2	1.42	36.1	1.90	48.3	0.24	6.1	0.140	3.6	0.84	1.26	0.08	0.011
2	1.86	47.1	2.38	60.3	0.26	6.6	0.150	3.8	1.16	1.74	0.14	0.019
3	2.92	74.2	3.50	88.9	0.29	7.4	0.180	4.6	1.97	2.94	0.35	0.047
4	3.84	97.5	4.50	114.3	0.33	8.4	0.220	5.6	2.91	4.35	0.60	0.080
6	5.97	152.0	6.63	168.4	0.33	8.4	0.220	5.6	4.39	6.57	1.45	0.194
8	7.97	202.0	8.63	219.2	0.33	8.4	0.220	5.6	5.78	8.65	2.59	0.348
10	10.10	256.0	10.75	273.1	0.33	8.4	0.220	5.6	7.26	10.90	4.15	0.555
12	12.10	307.0	12.75	323.9	0.33	8.4	0.220	5.6	8.65	13.00	5.96	0.797
14	13.30	339.0	14.00	355.6	0.33	8.4	0.220	5.6	9.52	14.30	7.26	0.971

\* All values are nominal. Tolerances or maximum/minimum limits can be obtained from Smith Fibercast.

### ASTM D2997 Designation Codes†:

1 - 1 1/2"	RTRP-22BS-3446
2" - 6"	RTRP-22BS-4446
8"	RTRP-22BS-4445
10" - 12"	RTRP-22BS-4444
14"	RTRP-22BS-4443

† Mechanical properties cell classifications shown are minimum. Actual classifications may be higher for some sizes.

### Pipe Lengths Available

Size (In.)	Length (Ft.)
1 - 14	20*

\* Pipe is offered in random or exact lengths. Random lengths are from 18.0 to 20.4 feet long.

### Pressure Ratings for Uninsulated Piping Systems <sup>(1)(2)</sup>

Nominal Pipe Size (In.)	Max. Internal Pressure @ 175°F (psig)			Maximum External Pressure <sup>(6)</sup>		
	Socket Pressure	Flanged Pressure	Other Pressure	@ 75°F	@150°F	@ 175°F
	Fittings <sup>(3)</sup>	Fittings <sup>(4)</sup>	Fittings <sup>(5)</sup>			
1	300	300	NA	1975	1679	1383
1 1/2	300	300	NA	1034	878	775
2	275	200	125	1013	861	759
3	200	150	125	467	397	350
4	150	150	100	425	361	319
6	150	150	100	218	185	163
8	150	150	100	69	59	52
10	150	150	75	34	29	26
12	150	150	75	43	36	32
14	125	150	75	16	14	12

(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) Specially fabricated higher pressure fittings are available on request. For insulated and/or heat traced piping systems, reduce pressure rating by 30% for 175° to 200°F operating temperatures. For compressible gasses, consult the factory for pressure ratings. CENTRICAST CL-2030 pipe and vinyl ester fittings can be used in insulated drainage and vent systems up to 200°F operating temperatures. 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, saddles and grooved nipples.

(6) Ratings shown are 50% of ultimate. 14.7 psi external pressure is equal to full vacuum.

NA = Not available at time of printing.

# CENTRICAST PLUS® CL-2030 Pipe

## Average Physical Properties<sup>(1)</sup>

Property	Size				Size				Size			
	@ 75° F / @ 24° C				@ 150° F / @ 66° C				@ 175° F / @ 80° C			
	1" - 1 1/2"		2" - 14"		1" - 1 1/2"		2" - 14"		1" - 1 1/2"		2" - 14"	
	psi	MPa	psi	MPa	psi	MPa	psi	MPa	psi	MPa	psi	MPa
<b>Axial Tensile – ASTM D2105</b>												
Ultimate Stress	22,000	150	22,000	150	19,000	130	19,000	130	18,000	120	18,000	120
Design Stress	5,500	38	5,500	38	4,750	33	4,750	33	4,500	31	4,500	31
Modulus of Elasticity	2.1E+06	14500	2.1E+06	14500	1.8E+06	12400	1.8E+06	12400	1.8E+06	12400	1.8E+06	12400
<b>Poisson's Ratio</b>	0.15				0.15				0.15			
<b>Axial Compression – ASTM D695</b>												
Ultimate Stress	26,000	180	32,000	220	24,000	170	30,000	210	18,000	120	22,000	150
Design Stress	6,500	45	8,000	55	6,000	41	7,500	52	4,500	31	5,500	38
Modulus of Elasticity	3.3E+06	22800	2.6E+06	17900	2.9E+06	20000	2.3E+06	15900	2.8E+06	19300	2.2E+06	15100
<b>Beam Bending – ASTM D2925</b>												
Ultimate Stress	22,000	150	40,000	280	19,000	130	35,000	240	18,000	120	33,000	230
Design Stress	2,750	19	5,000	34	2,375	16	4,375	30	2,250	16	4,125	28
Modulus of Elasticity (long term)	3.3E+06	22800	3.3E+06	22800	2.9E+06	20000	2.9E+06	20000	2.8E+06	19300	2.8E+06	19300
<b>Hydrostatic Burst – ASTM D1599</b>												
Ultimate Hoop Tensile Stress	25,000	170	30,000	210	21,000	140	26,000	180	20,000	140	25,000	170
Hoop Tensile Modulus of Elasticity	3.0E+06	20700	3.2E+06	22100	2.6E+06	17900	2.8E+06	19300	2.5E+06	17200	2.7E+06	18600
<b>Hydrostatic Design – ASTM D2992, Procedure B – Hoop Tensile Stress<sup>(1)</sup> Static 50 Year @ 175°F</b>	-	-	-	-	-	-	-	-	8,600	60	8,600	60
<b>Coefficient of Linear Thermal Expansion – ASTM D696</b>	8.9 x 10 <sup>-6</sup> in./in./°F (Non-Insulated Pipe) • 16.1x10 <sup>-6</sup> mm/mm°C (Non-Insulated Pipe) 10.0 x 10 <sup>-6</sup> in./in./°F (Insulated Pipe) • 18.1x10 <sup>-6</sup> mm/mm°C (Insulated Pipe)											
<b>Thermal Conductivity</b>	0.07 BTU/(ft)(hr)(°F) • 0.04 W/(m)(°C)											
<b>Specific Gravity (Density)</b>	1.56 (0.056 Lb/in. <sup>3</sup> ) • (1.56 g/cm <sup>3</sup> )											
<b>Hazen-Williams Flow Factor</b>	C-150											
<b>Surface Roughness</b>	1.7 x 10 <sup>-5</sup> Feet											
<b>Manning's "n"</b>	0.009											

(1) Stress and modulus values can be interpolated between temperatures shown. Consult the factory for Modulus of Elasticity values between 175°F and 225°F.

## Properties of Pipe Sections Based on Minimum Reinforced Walls

Size (In.)	Reinforcement End Area (In. <sup>2</sup> )	Reinforcement Moment of Inertia (In. <sup>4</sup> )	Reinforcement Section Modulus (In. <sup>3</sup> )	Total Wall End Area (In. <sup>2</sup> )
1	0.36	0.07	0.10	0.67
1 1/2	0.77	0.30	0.32	1.25
2	1.05	0.65	0.55	1.73
3	1.88	2.59	1.48	2.92
4	2.96	6.79	3.02	4.32
6	4.43	22.70	6.86	6.53
8	5.81	51.30	11.90	8.60
10	7.28	100.00	18.80	10.80
12	8.66	170.00	26.70	12.90
14	9.52	226.00	32.30	14.20

## Recommended Operating Ratings

Size (In.)	Axial Tensile Loads Max. (Lbs.)		Axial Compressive Loads Max. (Lbs.)		Bending Radius Min. (Ft.)  Entire Temp. Range	Torque Max. (Ft.·Lbs.)  Entire Temp. Range	Parallel Plate Loading <sup>(3)</sup> @ 5% Deflection & 75°F ASTM D2412		
	@ 75° F	@ 175°F <sup>(1)</sup>	@ 75° F	@ 175°F <sup>(1)(2)</sup>			Stiffness Factor In. <sup>3</sup> ·Lbs./In. <sup>2</sup>	Pipe Stiffness (psi)	Hoop Modulus x 10 <sup>6</sup> (psi)
	1	2000	1600	2400					
1½	4300	3500	5000	3500	95	132	457	4504	2.0
2	5800	4700	8400	5800	65	229	563	2742	2.0
3	10300	8400	15000	10300	96	618	1215	1783	2.5
4	16300	13300	23700	16300	124	1260	2218	1519	2.5
6	24300	19900	35400	24300	182	2860	2218	453	2.5
8	32000	26100	46500	32000	237	4960	2662	241	3.0
10	40000	32800	58200	40000	296	7820	2662	122	3.0
12	47600	39000	69300	47600	351	11100	2662	73	3.0
14	52400	42900	76200	52400	385	13500	2662	55	3.0

(1) Consult the factory for design recommendations above 175°F.

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

(3) Burial calculations should be based on 5% deflection as shown in table above.

## SUPPORTS

The following engineering analysis must be performed to determine the maximum support spacing for the piping system. Proper pipe support spacing depends on the temperature and weight of the fluid carried in the pipe. The support spacing is calculated using continuous beam equations and the pipe bending modulus derived from long-term beam bending tests. The following tables were developed to ensure a design that limits beam mid-span deflection to ½ inch and bending stresses to less than or equal to ⅛ of the ultimate bending stress. Any additional weight on the piping system such as insulation or heat tracing requires further consideration. Restrained (anchored) piping systems operating at elevated temperatures often result in guide spacing requirements that are more stringent than simple unrestrained piping systems. In this case, the maximum guide spacing will dictate the support/guide spacing requirements for the system. Pipe support spans at changes in direction require special attention. Supported and unsupported fittings at changes in direction 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, anchors, and guides:

- 1 Do not exceed the recommended support span.
- 2 Support valves and heavy in-line equipment independently. This applies to both vertical and horizontal piping.
- 3 Protect pipe from external abrasion.
- 4 Avoid point contact loads.

- 5 Avoid excessive bending. This applies to handling, transporting, initial layout, and final installed position.
- 6 Avoid excessive vertical run loading. Vertical loads should be supported sufficiently to minimize bending stresses at outlets or changes in direction.
- 7 Provide adequate axial and lateral restraint to ensure line stability during rapid changes in flow.

### Maximum Support Spacing for Uninsulated Pipe\*

Nom. Pipe Size (In.)	Continuous Spans of Pipe (Ft.) Specific Gravity=1.0, Deflection=½"		
	Temperature		
	75°F	150°F	175°F
1	13.5	13.1	13.0
1½	16.4	15.9	15.8
2	17.9	17.3	17.2
3	21.0	20.4	20.2
4	23.7	22.9	22.7
6	26.7	25.8	25.6
8	28.8	27.9	27.7
10	30.7	29.7	29.4
12	32.2	31.1	30.9
14	33.0	31.9	31.7

\* Consult factory for insulated pipe support spacing and operating temperatures between 175°F and 200°F.

# CENTRICAST PLUS® CL-2030 Pipe

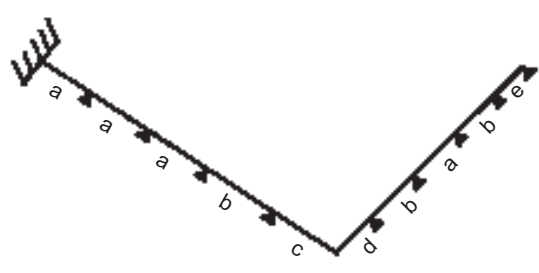
## Support Spacing vs. Specific Gravity

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 = 23.8 x 0.9 = 21.4 ft.

## Piping Span Adjustment Factors With Unsupported Fitting at Change in Direction

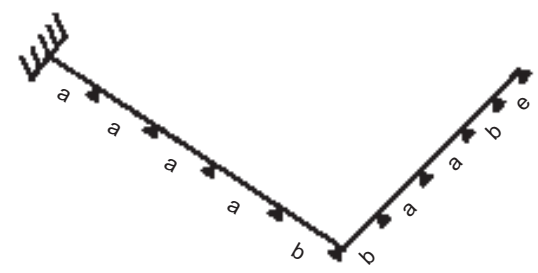
Span Type	Factor
a Continuous interior or fixed end spans	1.00
b Second span from simple supported end or unsupported fitting	0.80
c + d Sum of unsupported spans at fitting	≤ 0.75*
e Simple supported end span	0.67



\*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

Type of Span	Adjustment 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 flexibilities 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 Smith Fibercast's "Engineering and Piping Design Guide", Manual No. E5000, Section 3.



# CENTRICAST PLUS® CL-2030 Pipe

## Unrestrained Thermal Expansion Uninsulated Pipe<sup>(1)</sup>

Change in Temperature (°F)	Pipe Change in Length (In./100 Ft.)
25	0.27
50	0.53
75	0.80
100	1.07
125	1.34
150	1.60
175	1.87
200	2.14

## Restrained Thermal Expansion Pipe Compressive End Loads Uninsulated Pipe<sup>(1)</sup>

Nominal Pipe Size (in)	End Loads (Lbs./°F)	Nominal Pipe Size (in)	End Loads (Lbs./°F)
1	10.69	6	102.44
1½	22.73	8	134.42
2	30.79	10	168.41
3	43.44	12	200.40
4	68.45	14	220.39

## Allowable Bending Moment 90° Elbow

Nominal Pipe Size (in)	Allowable Moment (Ft•Lbs.)	Nominal Pipe Size (in)	Allowable Moment (Ft•Lbs.)
1	100	6	1,650
1½	150	8	2,850
2	225	10	4,500
3	475	12	6,500
4	650	14	10,000

(1) Consult the factory for thermal expansion and compressive end loads of insulated pipe.

## Maximum Guide Spacing for Restrained Thermal End Loads (Feet)

Nominal Pipe Size (In.)	Temperature Change °F*							
	25	50	75	100	125	150	175	200
1	7.0	4.9	4.0	3.5	3.1	2.9	2.6	2.5
1½	10.1	7.1	5.8	5.0	4.5	4.1	3.8	3.6
2	14.4	10.2	8.3	7.2	6.4	5.9	5.4	5.1
3	21.4	15.1	12.4	10.7	9.6	8.7	8.1	7.6
4	27.6	19.5	15.9	13.8	12.3	11.3	10.4	9.8
6	41.3	29.2	23.8	20.6	18.5	16.8	15.6	14.6
8	54.1	38.3	31.3	27.1	24.2	22.1	20.5	19.1
10	67.8	48.0	39.2	33.9	30.3	27.7	25.6	24.0
12	80.7	57.1	46.6	40.3	36.1	32.9	30.5	28.5
14	88.7	62.8	51.2	44.4	39.7	36.2	33.5	31.4

\*Note: Temperature Change = Maximum Fluid Temperature - Installation Temperature.

## Expansion Loop Minimum Leg Length (Feet)\*

Size (In.)	Total Deflection to be Absorbed (inches)										
	1/2	1	2	3	4	5	6	7	8	9	10
1	2.9	4.1	5.8	7.2	8.3	9.2	10.1	10.9	11.7	12.4	13.1
1½	3.5	5.0	7.0	8.6	9.9	11.1	12.2	13.1	14.0	14.9	15.7
2	2.9	4.1	5.8	7.1	8.2	9.2	10.0	10.8	11.6	12.3	13.0
3	4.0	5.6	7.9	9.7	11.2	12.5	13.7	14.8	15.8	16.8	17.7
4	5.5	7.7	10.9	13.4	15.5	17.3	19.0	20.5	21.9	23.2	24.5
6	6.3	8.9	12.6	15.4	17.8	19.9	21.8	23.5	25.1	26.7	28.1
8	7.2	10.2	14.4	17.6	20.3	22.7	24.9	26.9	28.7	30.5	32.1
10	8.0	11.3	16.0	19.6	22.7	25.3	27.8	30.0	32.1	34.0	35.8
12	8.7	12.2	17.3	21.2	24.5	27.4	30.0	32.4	34.6	36.7	38.7
14	8.0	11.4	16.1	19.7	22.8	25.5	27.9	30.1	32.2	34.1	36.0

\*Note: Multiply expansion loop minimum leg length by 1.414 for directional change cantilever leg length.

# CENTRICAST PLUS® CL-2030 Pipe

## TESTING

See Section 3 of Smith Fibercast Manual No. F6080, Pipe Installation Handbook: Hydrostatic Testing and System Start Up.

When possible, Smith Fibercast piping systems should be hydrostatically tested prior to being put into service. Care should be taken when testing, as in actual installation, 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.

## OTHER CONSIDERATIONS

### Water (Fluid) Hammer

A high pressure surge may be created that interrupts flow in the event of a pump startup or a quick closing valve. This surge can be significantly reduced by controlling pump startup and valve closure rates.

The maximum pressure surge in psig caused by water hammer can be calculated by multiplying the fluid velocity in ft./sec. times the constant listed in this table. The instantaneous peak pressure for the system will equal the water hammer surge plus the pressure in the system at the time the water hammer occurred.

Water (Fluid) Hammer Constants<sup>(1)</sup>

Nominal Pipe Size (in)	Constants	Nominal Pipe Size (in)	Constants
1	45.1	6	33.8
1½	44.8	8	30.3
2	43.2	10	27.6
3	40.0	12	25.6
4	39.1	14	24.6

(1) Constants are valid for water at 75°F.

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STAR • SMITH • FIBERCAST

P.O. Box 968 • 25 South Main • Sand Springs, OK 74063  
(918) 245-6651 • Fax: (918) 245-7566 or Fax: (800) 365-7473

2700 West 65th Street • Little Rock, AR 72209  
(501) 568-4010 • Fax: (501) 568-4465

<http://www.smithfibercast.com>

