



Fiberstrong™ R-P series
Restrained
Fiberglass Reinforced Polyester
pipe systems

Large diameter pipe
Product Specification



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Fiberstrong™ R-P Series
Large diameter Fiberglass Reinforced Polyester
(FRP) Restrained Pipe Systems

A. Description

1. General

Fiberstrong™ R-P pressure pipes and joints are a corrosion-resistant composite restrained piping system constructed for aggressive environments, aboveground, or underground without requiring thrust blocks. It consists of a thermosetting chemical-resistant Polyester resin, fiberglass reinforcements, ultra-violet stabilizers (for aboveground use) and additives as required. Standard pressure classes are 75, 100, 150, 175 and 250 Psig. Full vacuum series are also available. Nominal internal diameter is 16" to 158". Maximum allowable service temperature is 125 ° F.

2. Manufacturing

State of the art continuous filament winding machines are used by Future Pipe Industries (FPI) for the manufacturing of the FRP composite pipes.



3. Construction

The standard pipe shall be a composite laminate consisting of a corrosion resistant liner, a structural layer, and an exterior layer.

- a. The interior resin-rich liner of the pipe shall approximately be 40 mil (1 mm) thick, consisting of fiberglass "C" glass mat and chopped rovings impregnated with Polyester resin.
- b. The structural layer of the pipe shall be reinforced with closely spaced continuous fiberglass filament winding and/or fiberglass woven roving and chopped roving impregnated with Polyester resin.
- c. The exterior layer of the pipe shall be resin-rich with a minimum thickness of 0.3 mm, reinforced with a C glass mat or tveil.

4. Applicable Codes / Standards

- ASTM D 2996
- AWWA M 45
- ASME B 31.3

5. The product series identifies the type of installation:

Series **A** stands for **Aboveground**, **B** stands for **Buried** pipe systems.

6. Pressure Class

The pressure class indicates the maximum allowable internal pressure (psig) that the pipe can resist for a design life of 50 years including an adequate service or safety factor. De-rating may be required for service temperatures above 95 ° F.

- C75** : stands for **75** Psig operating pressure
- C75 FV** :stands for **75** psig operating pressure; **Full Vacuum**
- C100** : stands for **100** Psig operating pressure
- C150** : stands for **150** Psig operating pressure
- C175** : stands for **175** Psig operating pressure
- C250** : stands for **250** Psig operating pressure

B. Use and Application



1. Service Environment

Fiberstrong™ restrained pipe is suitable for use in corrosive environments, including aggressive sanitary sewage, raw water, seawater and many industrial effluents up to a maximum service temperature of 112° F.

2. Pressure and Loading Limitations

Pressure classes	C75, C100, C125, C150, C175, C250 and C75 FV (full vacuum)
Maximum Allowable Vacuum	Variable, refer tables in section E 9
Maximum installed (Field) test Pressure:	1.33 x Design Pressure
Minimum Pipe Factory test Pressure	: 2 x Pressure Class

C. Joints

1. Flanges

Flanges are filament wound or contact molded, utilizing Neoprene flat faced gaskets for sizes up to DN 36" and O ring gaskets for larger sizes. Standard flanges are drilled to AWWA C207 Class B pattern. Other drilling standards are also available.

2. Lamination (Butt & Wrap)

Pipe and fittings are normally provided with plain ends suitable for lamination joint (Butt & Wrap).

D. Pipe Thickness*

Aboveground series – pipe total wall thickness (with standard liner) is as follows:

Inner Diameter ID (Inch)	Thickness Series A, C75 (inch)	Thickness Series A, C100 (inch)	Thickness Series A C150 (inch)	Thickness Series A C175 (inch)	Thickness Series A C250 (inch)	Thickness Series A C75 FV (inch)
16	0.209	0.252	0.354	0.406	0.563	0.366
18	0.228	0.280	0.394	0.449	0.626	0.390
20	0.248	0.303	0.433	0.496	0.689	0.409
24	0.287	0.354	0.508	0.583	0.819	0.453
27	0.315	0.390	0.563	0.650	0.913	0.480
30	0.346	0.429	0.622	0.717	1.008	0.508
33	0.374	0.465	0.677	0.783	1.106	0.535
36	0.406	0.504	0.736	0.846	1.201	0.606
42	0.461	0.579	0.846	0.980	1.394	0.661
48	0.520	0.654	0.961	1.114	1.583	0.713
54	0.579	0.728	1.075	1.244	-	0.760
60	0.638	0.803	1.189	1.378	-	0.862
63	0.665	0.839	1.244	1.445	-	0.886
66	0.697	0.878	1.303	1.512	-	0.909
72	0.756	0.953	1.417	1.642	-	0.957
75	0.783	0.988	1.472	1.709	-	0.976
78	0.815	1.028	1.528	1.776	-	1.118
81	0.843	1.063	1.587	1.843	-	1.142
84	0.870	1.102	1.642	1.909	-	1.165
90	0.929	1.177	1.756	2.039	-	1.213

* Thickness based on standard 40 mil (1 mm) liner.

Continued – wall thickness table, Aboveground pipe series

Inner Diameter ID (Inch)	Thickness Series A, C75 (inch)	Thickness Series A, C100 (inch)	Thickness Series A C150 (inch)	Thickness Series A C175 (inch)	Thickness Series A C250 (inch)	Thickness Series A C75 FV (inch)
96	0.99	1.25	1.87	2.17	-	1.26
99	1.02	1.29	1.93	0.00	-	1.28
102	1.05	1.33	1.98	-	-	1.30
105	1.08	1.36	2.04	-	-	1.32
108	1.11	1.40	2.10	-	-	1.34
114	1.17	1.48	-	-	-	1.51
120	1.22	1.55	-	-	-	1.56
123	1.25	1.59	-	-	-	1.58
126	1.28	1.63	-	-	-	1.60
129	1.31	1.66	-	-	-	1.63
132	1.34	1.70	-	-	-	1.65
138	1.40	1.78	-	-	-	1.69
144	1.46	1.85	-	-	-	1.73
147	1.48	1.89	-	-	-	1.75
150	1.52	1.93	-	-	-	1.77
156	1.58	2.00	-	-	-	1.81
158	1.59	2.02	-	-	-	1.83

* Thickness based on standard 40 mil (1 mm) liner.

Buried Series-pipe total wall thickness (with standard liner) is as follows:

Inner Diameter ID (Inch)	Thickness – Series B, C75 (inch)	Thickness – Series B, C100 (inch)	Thickness – Series B C150 (inch)	Thickness – Series B C175 (inch)	Thickness – Series B C250 (inch)
16	0.213	0.260	0.366	0.406	0.559
18	0.228	0.283	0.406	0.449	0.622
20	0.248	0.311	0.445	0.492	0.681
24	0.287	0.358	0.520	0.579	0.807
27	0.315	0.394	0.575	0.642	0.902
30	0.346	0.433	0.634	0.709	0.992
33	0.374	0.469	0.689	0.772	1.087
36	0.406	0.508	0.748	0.835	1.181
42	0.461	0.579	0.858	0.965	1.366
48	0.520	0.654	0.972	1.094	1.551
54	0.579	0.728	1.087	1.224	-
60	0.638	0.799	1.201	1.350	-
63	0.665	0.839	1.256	1.417	-
66	0.697	0.874	1.315	1.480	-
72	0.756	0.949	1.429	1.610	-
75	0.783	0.984	1.484	1.673	-
78	0.815	1.024	1.543	1.736	-
81	0.843	1.059	1.598	1.803	-
84	0.870	1.094	1.654	1.866	-
90	0.929	1.169	1.768	1.996	-

* Thickness based on standard 40 mil (1 mm) liner.

Continued - Wall thickness table, Buried pipe series

Inner Diameter ID (Inch)	Thickness – Series CTB 75 (inch)	Thickness – Series CTB 100 (inch)	Thickness – Series CTB 150 (inch)	Thickness – Series CTB 175 (inch)	Thickness – Series CTB 250 (inch)
96	0.988	1.244	1.882	2.126	-
99	1.020	1.280	1.941	-	-
102	1.047	1.319	1.996	-	-
105	1.075	1.354	2.051	-	-
108	1.106	1.390	2.110	-	-
114	1.165	1.465	-	-	-
120	1.224	1.539	-	-	-
123	1.252	1.575	-	-	-
126	1.280	1.614	-	-	-
129	1.311	1.650	-	-	-
132	1.339	1.685	-	-	-
138	1.398	1.760	-	-	-
144	1.457	1.835	-	-	-
147	1.484	1.870	-	-	-
150	1.516	1.909	-	-	-
156	1.575	1.980	-	-	-
158	1.594	2.008	-	-	-

* Thickness based on standard 40 mil (1 mm) liner.

E. Physical / Mechanical Properties

1. Thermal Expansion

The approximate axial co-efficient of thermal expansion of Fiberstrong™ restrained pipe is 18 to 27 x 10⁻⁶ cm/cm/Deg. C (measured according to ASTM D696).

2. Poisson's Ratio

Axial/Hoop due to load in Hoop direction: 0.3

Hoop/Axial due to load in Axial direction: 0.17

3. Flow Characteristics

Pipe wall friction factors:

Hazen Williams C = 150

4. Fluid (Water) Hammer

Specific Gravity of pipe wall: 1.85

Volumetric Elasticity modulus : $E_v = 2,509,150$ psi (17,300 MPa) .

5. Material Properties

Fiberstrong™ restrained pipe structural wall has the following properties:

<u>Property</u>	<u>Test Method</u>	<u>Value</u>	<u>Unit</u>
Hydrostatic Design Basis (Biaxial - @ 50 years)	ASTM D 2992	8,700	psi
		60	MPa
Lower Confidence Limit (Biaxial - @ 50 years)	ASTM D 2992	8,122	psi
		56	MPa
Hydrostatic Design Stress – HDS $S_{A,W}^*$	ASTM D 2992	4,060	psi
		28	MPa
Axial Tensile Modulus	ASTM D 638	1,595,400	psi
		11,000	MPa
Axial Tensile Strength	ASTM D 638	12,330	psi
		85	MPa
Hoop Tensile Modulus	ASTM D 2290	2,900,750	psi
		20,000	MPa
Hoop Flexural Modulus	ASTM D 2412	2,900,750	psi
		20,000	MPa
Hoop Tensile Strength	ASTM D 2290	36,260	psi
		250	MPa
Hoop Tensile Strength	ASTM D 1599	29,000	psi
		200	MPa
Shear Modulus		1,696,850	psi
		11,700	MPa
Glass Content	ASTM D 2584	65	%
Laminate Density		115.44	Lb/ft ³
		1.85	gm/cm ³

6. Support Distances

The maximum recommended pipe support distances* for fluid service are as follows:

NOMINAL DIA (Inch)	Span - Ft Series A, C75	Span - Ft Series A, C100	Span - Ft Series A C150	Span - Ft Series A C175	Span - Ft Series A C250	Span - Ft Series A C75FV
16	16.2	17.1	20.5	22.0	25.8	13.1
18	17.2	18.6	22.0	23.3	27.3	13.1
20	18.1	19.3	23.3	24.9	28.8	13.1
24	19.9	21.3	25.4	27.1	31.8	13.1
27	20.9	22.3	26.8	28.8	33.6	13.1
30	22.3	23.8	28.5	30.4	35.4	13.1
33	23.2	24.7	29.7	32.0	37.3	13.1
36	24.5	26.0	31.3	33.1	38.9	16.4
42	26.0	28.0	33.5	35.9	40.0	16.4
48	27.9	29.9	35.9	38.5	40.0	16.4
54	29.6	31.7	38.1	40.0	-	16.4
60	31.3	33.4	40.0	40.0	-	19.7
63	31.9	34.0	40.0	40.0	-	19.7
66	32.8	35.0	40.0	40.0	-	19.7
72	34.3	36.5	40.0	40.0	-	19.7
75	34.9	37.1	40.0	40.0	-	19.7
78	35.8	38.0	40.0	40.0	-	26.2
81	36.3	38.6	40.0	40.0	-	26.2
84	36.9	39.4	40.0	40.0	-	26.2
90	38.2	40.0	40.0	40.0	-	26.2

* Spans to be confirmed by case specific stress analysis of the pipeline system.

Note: Above values are based on using the continuous span theory (pipes having rigid joints), a ½" (12.5 mm) maximum allowable sag and a fluid density of 62.4 lb/ft³ (1000 Kg/m³).

Continued-Support distance tables

NOMINAL DIA (Inch)	Span - Ft Series A, C75	Span - Ft Series A, C100	Span - Ft Series A C150	Span - Ft Series A C175	Span - Ft Series A C250	Span – Ft Series A C75FV
96	39.5	40.0	40.0	40.0	-	26.2
99	40.0	40.0	40.0	-	-	26.2
102	40.0	40.0	40.0	-	-	26.2
105	40.0	40.0	40.0	-	-	26.2
108	40.0	40.0	40.0	-	-	26.2
114	40.0	40.0	-	-	-	32.8
120	40.0	40.0	-	-	-	32.8
123	40.0	40.0	-	-	-	32.8
126	40.0	40.0	-	-	-	32.8
129	40.0	40.0	-	-	-	32.8
132	40.0	40.0	-	-	-	32.8
138	40.0	40.0	-	-	-	32.8
144	40.0	40.0	-	-	-	32.8
147	40.0	40.0	-	-	-	32.8
150	40.0	40.0	-	-	-	32.8
156	40.0	40.0	-	-	-	32.8
158	40.0	40.0	-	-	-	32.8

* Spans to be confirmed by case specific stress analysis of the pipeline system.

Note: Above values are based on using the continuous span theory (pipes having rigid joints), a ½” (12.5 mm) maximum allowable sag and a fluid density of 62.4 lb/ft³ (1000 Kg/m³).

7.0 Buckling Capability

Buckling rating for pipes installed underground is calculated in accordance with AWWA M 45 design manual. For pipes installed above ground the allowable buckling pressure is as shown below. Buckling pressure indicates the difference between external and internal pressure (positive if external pressure is larger than internal pressure).

Series	Inner Diameter ID (Inch)	Allowable Buckling Pressure (psig) for Various Supports Spans (ft)						
		3	6	12	18	24	30	40
Series A C75								
	16	11.6	5.8	2.9	-	-	-	-
	18	13.1	6.5	3.3	-	-	-	-
	20	14.5	7.3	3.6	2.4	-	-	-
	24	17.4	8.7	4.4	2.9	-	-	-
	27	19.2	9.6	4.8	3.2	-	-	-
	30	21.8	10.9	5.4	3.6	-	-	-
	33	23.6	11.8	5.9	3.9	-	-	-
	36	26.1	13.1	6.5	4.4	3.3	-	-
	42	29.8	14.9	7.4	5.0	3.7	-	-
	48	34.1	17.1	8.5	5.7	4.3	-	-
	54	38.5	19.2	9.6	6.4	4.8	-	-
	60	42.8	21.4	10.7	7.1	5.4	4.3	-
	63	44.7	22.3	11.2	7.4	5.6	4.5	-
	66	47.2	23.6	11.8	7.9	5.9	4.7	-
	72	51.6	25.8	12.9	8.6	6.4	5.2	-
	75	53.4	26.7	13.3	8.9	6.7	5.3	-
	78	55.9	28.0	14.0	9.3	7.0	5.6	-
	81	57.7	28.9	14.4	9.6	7.2	5.8	-
	84	59.6	29.8	14.9	9.9	7.4	6.0	-
90	63.9	32.0	16.0	10.7	8.0	6.4	-	
96	68.3	34.1	17.1	11.4	8.5	6.8	-	
99	70.8	35.4	17.7	11.8	8.9	7.1	5.3	
102	72.6	36.3	18.2	12.1	9.1	7.3	5.4	

Continued - Allowable buckling pressure table – Series A C75

Series	Inner Diameter	Allowable Buckling Pressure (psig) for Various Supports Spans (ft)						
		ID (Inch)	3	6	12	18	24	30
Series A C75	105	74.4	37.2	18.6	12.4	9.3	7.4	5.6
	108	77.0	38.5	19.2	12.8	9.6	7.7	5.8
	114	81.3	40.7	20.3	13.6	10.2	8.1	6.1
	120	85.7	42.8	21.4	14.3	10.7	8.6	6.4
	123	87.5	43.8	21.9	14.6	10.9	8.8	6.6
	126	89.3	44.7	22.3	14.9	11.2	8.9	6.7
	129	91.9	45.9	23.0	15.3	11.5	9.2	6.9
	132	93.7	46.8	23.4	15.6	11.7	9.4	7.0
	138	98.0	49.0	24.5	16.3	12.3	9.8	7.4
	144	102.4	51.2	25.6	17.1	12.8	10.2	7.7
	147	104.2	52.1	26.1	17.4	13.0	10.4	7.8
	150	106.8	53.4	26.7	17.8	13.3	10.7	8.0
	156	111.1	55.6	27.8	18.5	13.9	11.1	8.3
	158	112.6	56.3	28.1	18.8	14.1	11.3	8.4

Series	Inner Diameter ID (Inch)	Allowable Buckling Pressure (psig) for Various Supports Spans (ft)						
		3	6	12	18	24	30	40
Series A C100								
	16	21.2	10.6	5.3	-	-	-	-
	18	24.5	12.3	6.1	4.1	-	-	-
	20	26.8	13.4	6.7	4.5	-	-	-
	24	32.4	16.2	8.1	5.4	-	-	-
	27	35.8	17.9	8.9	6.0	-	-	-
	30	40.2	20.1	10.1	6.7	-	-	-
	33	43.6	21.8	10.9	7.3	5.5	-	-
	36	48.0	24.0	12.0	8.0	6.0	-	-
	42	55.9	27.9	14.0	9.3	7.0	-	-
	48	63.7	31.9	15.9	10.6	8.0	-	-
	54	71.6	35.8	17.9	11.9	8.9	7.2	-
	60	79.4	39.7	19.8	13.2	9.9	7.9	-
	63	82.8	41.4	20.7	13.8	10.3	8.3	-
	66	87.2	43.6	21.8	14.5	10.9	8.7	-
	72	95.1	47.5	23.8	15.8	11.9	9.5	-
	75	98.5	49.2	24.6	16.4	12.3	9.8	-
	78	102.9	51.4	25.7	17.1	12.9	10.3	-
	81	106.3	53.2	26.6	17.7	13.3	10.6	-
	84	110.7	55.4	27.7	18.5	13.8	11.1	-
	90	118.6	59.3	29.6	19.8	14.8	11.9	8.9
	96	126.4	63.2	31.6	21.1	15.8	12.6	9.5
	99	129.8	64.9	32.5	21.6	16.2	13.0	9.7
	102	134.2	67.1	33.6	22.4	16.8	13.4	10.1
	105	137.6	68.8	34.4	22.9	17.2	13.8	10.3
	108	142.1	71.0	35.5	23.7	17.8	14.2	10.7
114	149.9	75.0	37.5	25.0	18.7	15.0	11.2	
120	157.7	78.9	39.4	26.3	19.7	15.8	11.8	
123	161.2	80.6	40.3	26.9	20.1	16.1	12.1	
126	165.6	82.8	41.4	27.6	20.7	16.6	12.4	
129	169.0	84.5	42.2	28.2	21.1	16.9	12.7	
132	173.4	86.7	43.4	28.9	21.7	17.3	13.0	
138	181.3	90.6	45.3	30.2	22.7	18.1	13.6	
144	189.1	94.5	47.3	31.5	23.6	18.9	14.2	

Continued - Allowable buckling pressure table – Series A C100

Series	Inner Diameter ID (Inch)	Allowable Buckling Pressure (psig) for Various Supports Spans (ft)						
		3	6	12	18	24	30	40
Series A C100	147	192.5	96.2	48.1	32.1	24.1	19.2	14.4
	150	196.9	98.5	49.2	32.8	24.6	19.7	14.8
	156	204.8	102.4	51.2	34.1	25.6	20.5	15.4
	158	207.0	103.5	51.8	34.5	25.9	20.7	15.5
Series	Inner Diameter ID (Inch)	Allowable Buckling Pressure (psig) for Various Supports Spans (ft)						
		3	6	12	18	24	30	40
Series A C150								
	16	58.9	29.5	14.7	15.7	-	-	-
	18	67.0	33.5	16.8	11.2	-	-	-
	20	75.1	37.5	18.8	12.5	-	-	-
	24	89.3	44.7	22.3	14.9	11.2	-	-
	27	99.6	49.8	24.9	16.6	12.4	-	-
	30	111.7	55.8	27.9	18.6	14.0	-	-
	33	121.9	60.9	30.5	20.3	15.2	-	-
	36	134.0	67.0	33.5	22.3	16.8	13.4	-
	42	154.5	77.2	38.6	25.7	19.3	15.4	-
	48	176.8	88.4	44.2	29.5	22.1	17.7	-
	54	199.1	99.6	49.8	33.2	24.9	19.9	-
	60	221.5	110.7	55.4	36.9	27.7	22.1	16.6
	63	231.7	115.8	57.9	38.6	29.0	23.2	17.4
	66	243.8	121.9	60.9	40.6	30.5	24.4	18.3
	72	266.1	133.1	66.5	44.4	33.3	26.6	20.0
	75	276.4	138.2	69.1	46.1	34.5	27.6	20.7
	78	286.6	143.3	71.6	47.8	35.8	28.7	21.5
	81	298.7	149.3	74.7	49.8	37.3	29.9	22.4
	84	308.9	154.5	77.2	51.5	38.6	30.9	23.2
90	331.2	165.6	82.8	55.2	41.4	33.1	24.8	
96	353.6	176.8	88.4	58.9	44.2	35.4	26.5	
99	363.8	181.9	91.0	60.6	45.5	36.4	27.3	
102	375.9	188.0	94.0	62.7	47.0	37.6	28.2	
105	386.1	193.1	96.5	64.4	48.3	38.6	29.0	
108	398.3	199.1	99.6	66.4	49.8	39.8	29.9	

Series	Inner Diameter ID (Inch)	Allowable Buckling Pressure (psig) for Various Supports Spans (ft)						
		3	6	12	18	24	30	40
Series A C175								
	16	86.6	43.3	21.7	24.9	-	-	-
	18	96.9	48.4	24.2	16.1	-	-	-
	20	109.5	54.7	27.4	18.2	25.2	-	-
	24	129.9	65.0	32.5	21.7	16.2	-	-
	27	146.5	73.2	36.6	24.4	18.3	-	-
	30	163.0	81.5	40.8	27.2	20.4	16.3	-
	33	179.6	89.8	44.9	29.9	22.4	18.0	-
	36	193.7	96.9	48.4	32.3	24.2	19.4	-
	42	226.8	113.4	56.7	37.8	28.4	22.7	-
	48	259.9	129.9	65.0	43.3	32.5	26.0	-
	54	290.6	145.3	72.7	48.4	36.3	29.1	21.8
	60	323.7	161.8	80.9	53.9	40.5	32.4	24.3
	63	340.2	170.1	85.1	56.7	42.5	34.0	25.5
	66	356.8	178.4	89.2	59.5	44.6	35.7	26.8
	72	387.5	193.7	96.9	64.6	48.4	38.7	29.1
	75	404.0	202.0	101.0	67.3	50.5	40.4	30.3
	78	420.6	210.3	105.1	70.1	52.6	42.1	31.5
81	437.1	218.5	109.3	72.8	54.6	43.7	32.8	
84	453.6	226.8	113.4	75.6	56.7	45.4	34.0	
90	484.3	242.2	121.1	80.7	60.5	48.4	36.3	
96	517.4	258.7	129.4	86.2	64.7	51.7	38.8	

Series	Inner Diameter ID (Inch)	Allowable Buckling Pressure (psig) for Various Supports Spans (ft)						
		3	6	12	18	24	30	40
Series A C250								
	16	214.1	107.1	53.5	72.8	72.8	-	-
	18	239.9	119.9	60.0	72.4	72.4	-	-
	20	265.7	132.8	66.4	72.2	72.2	-	-
	24	321.2	160.6	80.3	53.5	72.8	72.8	-
	27	359.8	179.9	90.0	60.0	72.4	72.4	-
	30	398.5	199.2	99.6	66.4	49.8	72.2	-
	33	441.1	220.6	110.3	73.5	55.1	72.7	-
	36	479.8	239.9	119.9	80.0	60.0	48.0	-
	42	561.1	280.5	140.3	93.5	70.1	56.1	72.7
	48	638.4	319.2	159.6	106.4	79.8	63.8	47.9

Series	Inner Diameter ID (Inch)	Allowable Buckling Pressure (psig) for Various Supports Spans (ft)						
		3	6	12	18	24	30	40
Series A C75 FV								
	16	64.8	32.4	16.2	-	-	-	-
	18	65.1	32.6	16.3	-	-	-	-
	20	64.1	32.1	16.0	-	-	-	-
	24	65.0	32.5	16.2	-	-	-	-
	27	64.4	32.2	16.1	-	-	-	-
	30	64.3	32.1	16.1	-	-	-	-
	33	64.6	32.3	16.1	-	-	-	-
	36	79.6	39.8	19.9	13.3	-	-	-
	42	80.2	40.1	20.0	13.4	-	-	-
	48	80.4	40.2	20.1	13.4	-	-	-
	54	80.1	40.0	20.0	13.3	-	-	-
	60	95.8	47.9	23.9	16.0	12.0	-	-
	63	95.7	47.8	23.9	15.9	12.0	-	-
	66	95.7	47.9	23.9	16.0	12.0	-	-
	72	96.1	48.0	24.0	16.0	12.0	-	-
	75	95.4	47.7	23.9	15.9	11.9	-	-
	78	128.2	64.1	32.1	21.4	16.0	12.8	-
	81	128.0	64.0	32.0	21.3	16.0	12.8	-
	84	127.9	64.0	32.0	21.3	16.0	12.8	-
	90	128.0	64.0	32.0	21.3	16.0	12.8	-
	96	127.4	63.7	31.9	21.2	15.9	12.7	-
	99	127.8	63.9	31.9	21.3	16.0	12.8	-
	102	127.2	63.6	31.8	21.2	15.9	12.7	-
	105	127.6	63.8	31.9	21.3	16.0	12.8	-
	108	127.2	63.6	31.8	21.2	15.9	12.7	-
	114	159.3	79.7	39.8	26.6	19.9	15.9	-
120	159.8	79.9	40.0	26.6	20.0	16.0	-	
123	159.1	79.6	39.8	26.5	19.9	15.9	-	
126	159.5	79.7	39.9	26.6	19.9	15.9	-	
129	159.9	80.0	40.0	26.7	20.0	16.0	-	
132	159.4	79.7	39.8	26.6	19.9	15.9	-	
138	159.5	79.7	39.9	26.6	19.9	15.9	-	
144	159.8	79.9	39.9	26.6	20.0	16.0	-	

Continued - Allowable buckling pressure table – Series A C75 FV

Series	Inner Diameter	Allowable Buckling Pressure (psig) for Various Supports Spans (ft)						
	ID (Inch)	3	6	12	18	24	30	40
A C75 FV	147	159.5	79.7	39.9	26.6	19.9	15.9	-
	150	159.3	79.6	39.8	26.5	19.9	15.9	-
	156	159.0	79.5	39.7	26.5	19.9	15.9	-
	158	159.5	79.7	39.9	26.6	19.9	15.9	-

8.0 Pipe Stiffness

Pipe Stiffness (PS) * values for series **A** (Aboveground pipe) is:

Inner Diameter ID (Inch)	PS Series A C75 (psi)	PS Series A C100 (psi)	PS Series A C 150 (psi)	PS Series A C175 (psi)	PS Series A C250 (psi)	PS Series A C75FV (psi)
16	11.0	22.7	76.7	121.3	355.5	85.8
18	11.0	23.4	77.8	120.6	354.1	75.1
20	11.0	23.0	78.6	123.2	353.0	65.1
24	11.0	23.2	77.9	121.7	356.6	53.3
27	10.8	22.7	77.1	122.1	355.0	45.8
30	11.0	23.0	78.0	122.4	353.8	40.4
33	10.9	22.7	77.3	122.7	356.7	36.2
36	11.1	22.9	78.1	121.1	355.5	42.0
42	10.8	22.9	77.0	121.7	356.8	35.2
48	10.8	22.8	77.2	122.1	355.0	30.1
54	10.8	22.8	77.3	121.3	-	26.1
60	10.9	22.7	77.4	121.7	-	28.5
63	10.8	22.6	77.1	121.8	-	26.8
66	10.9	22.7	77.5	122.0	-	25.4
72	10.9	22.7	77.6	121.4	-	23.0
75	10.8	22.5	77.3	121.5	-	21.7
78	10.9	22.7	77.0	121.6	-	29.5
81	10.8	22.5	77.4	121.8	-	28.1
84	10.8	22.7	77.1	121.9	-	26.9
90	10.8	22.6	77.2	121.4	-	24.8

* Based on structural wall thickness

Continued - Pipe Stiffness (PS)^{*} values for series A (Aboveground pipe)

Inner Diameter ID (Inch)	PS Series A C75 (psi)	PS Series A C100 (psi)	PS Series A C 150 (psi)	PS Series A C175 (psi)	PS Series A C250 (psi)	PS Series A C75FV (psi)
96	10.8	22.6	77.3	121.6	-	22.9
99	10.9	22.5	77.1	-	-	22.1
102	10.8	22.6	77.4	-	-	21.2
105	10.8	22.5	77.2	-	-	20.6
108	10.8	22.6	77.4	-	-	19.8
114	10.9	22.6	-	-	-	24.3
120	10.9	22.6	-	-	-	22.9
123	10.8	22.5	-	-	-	22.2
126	10.8	22.6	-	-	-	21.6
129	10.8	22.5	-	-	-	21.1
132	10.8	22.6	-	-	-	20.4
138	10.8	22.6	-	-	-	19.4
144	10.8	22.6	-	-	-	18.4
147	10.8	22.5	-	-	-	18.0
150	10.8	22.6	-	-	-	17.5
156	10.8	22.6	-	-	-	16.7
158	10.8	22.5	-	-	-	16.5

* Based on structural wall thickness

Pipe Stiffness (PS)^{*} values for series **B** (Buried pipe) is:

Inner Diameter ID (Inch)	PS– Series B C75 (psi)	PS– Series B C100 (psi)	PS– Series B C150 (psi)	PS– Series B C175 (psi)	PS– Series B C 250 (psi)
16	11.8	25.4	85.8	121.3	347.6
18	11.0	24.7	85.9	120.6	347.1
20	11.0	25.2	86.0	120.0	340.4
24	11.0	24.1	84.0	119.1	340.8
27	10.8	23.5	82.5	117.4	341.1
30	11.0	23.8	82.9	118.2	337.1
33	10.9	23.3	81.7	116.9	337.7
36	11.1	23.5	82.1	115.9	338.1
42	10.8	22.9	80.4	115.7	335.9
48	10.8	22.8	80.2	115.6	334.2
54	10.8	22.8	80.0	115.5	-
60	10.9	22.4	79.8	114.4	-
63	10.8	22.6	79.4	114.9	-
66	10.9	22.4	79.7	114.4	-
72	10.9	22.4	79.6	114.4	-
75	10.8	22.3	79.2	114.0	-
78	10.9	22.4	79.5	113.7	-
81	10.8	22.3	79.1	114.1	-
84	10.8	22.2	78.8	113.7	-
90	10.8	22.2	78.8	113.8	-

* Based on structural wall thickness

continued - Pipe Stiffness (PS)^{*} for series B (Buried pipe)

Inner Diameter ID (Inch)	PS– Series B C75 (psi)	PS– Series B C100 (psi)	PS– Series B C150 (psi)	PS– Series B C175 (psi)	PS– Series B C 250 (psi)
96	10.8	22.2	78.8	113.9	-
99	10.9	22.1	79.0	-	-
102	10.8	22.2	78.8	-	-
105	10.8	22.1	78.5	-	-
108	10.8	22.0	78.7	-	-
114	10.9	22.0	-	-	-
120	10.9	22.1	-	-	-
123	10.8	22.0	-	-	-
126	10.8	22.1	-	-	-
129	10.8	22.0	-	-	-
132	10.8	21.9	-	-	-
138	10.8	22.0	-	-	-
144	10.8	22.0	-	-	-
147	10.8	21.9	-	-	-
150	10.8	22.0	-	-	-
156	10.8	21.9	-	-	-
158	10.8	22.0	-	-	-

* Based on structural wall thickness

9. Nominal weight

The nominal pipe weight in lbs /foot is (for handling purposes only) :

Inner Diameter ID (Inch)	Weight Series A C75 (lb/ft)	Weight Series A C100 (lb/ft)	Weight Series A C 150 (lb/ft)	Weight Series A C175 (lb/ft)	Weight Series A C250 (lb/ft)	Weight Series A C75FV (lb/ft)
16	8.8	10.1	14.8	16.8	23.6	15.5
18	10.8	12.8	18.2	20.9	29.6	18.2
20	12.8	15.5	22.2	25.6	36.3	20.9
24	17.5	21.6	31.6	36.3	51.1	28.3
27	21.6	26.9	39.0	45.1	64.6	33.6
30	26.9	33.0	48.4	55.8	78.7	39.0
33	31.6	39.0	57.8	66.6	95.5	45.1
36	37.0	46.4	68.6	78.7	112.9	55.8
42	49.1	61.9	91.4	106.2	152.6	71.3
48	63.9	80.0	118.3	137.8	197.6	87.4
54	80.0	101.0	150.0	174.0	-	105.0
60	98.0	123.0	184.0	214.0	-	133.0
63	107.0	136.0	202.0	235.0	-	143.0
66	117.0	148.0	222.0	258.0	-	154.0
72	139.0	176.0	263.0	305.0	-	177.0
75	150.0	190.0	284.0	331.0	-	187.0
78	162.0	205.0	307.0	357.0	-	224.0
81	175.0	220.0	330.0	385.0	-	237.0
84	187.0	237.0	355.0	414.0	-	250.0
90	214.0	271.0	406.0	474.0	-	279.0

Continued – Weight tables – Series A

Inner Diameter ID (Inch)	Weight Series A C75 (lb/ft)	Weight Series A C100 (lb/ft)	Weight Series A C 150 (lb/ft)	Weight Series A C175 (lb/ft)	Weight Series A C250 (lb/ft)	Weight Series A C75FV (lb/ft)
96	241	307	461	538	-	308
99	257	325	490	-	-	323
102	272	345	520	-	-	338
105	288	365	550	-	-	354
108	304	386	582	-	-	370
114	338	429	-	-	-	440
120	374	475	-	-	-	478
123	392	498	-	-	-	496
126	411	523	-	-	-	515
129	431	547	-	-	-	536
132	450	573	-	-	-	554
138	491	626	-	-	-	595
144	534	680	-	-	-	636
147	555	708	-	-	-	657
150	579	737	-	-	-	677
156	626	796	-	-	-	720
158	641	816	-	-	-	736

Diameter ID (Inch)	Weight-Series B C75 (lb/ft)	Weight-Series B C100 (lb/ft)	Weight-Series B C150 (lb/ft)	Weight-Series B C175 (lb/ft)	Weight-Series B C250 (lb/ft)
16	8.7	10.8	15.5	16.8	23.5
18	10.8	13.4	18.8	20.8	29.6
20	12.8	16.1	22.8	25.5	35.6
24	17.5	22.2	32.3	35.6	50.4
27	21.5	27.6	40.3	45.0	63.2
30	26.9	33.6	49.1	55.1	77.3
33	31.6	39.6	58.5	65.9	93.4
36	37.0	47.0	69.2	77.3	111
42	49.1	61.8	92.7	105	150
48	63.9	80.0	121	136	194
54	80	101	152	171	-
60	97	123	186	209	-
63	107	136	204	230	-
66	117	148	224	252	-
72	139	175	265	300	-
75	150	189	287	324	-
78	162	204	310	349	-
81	175	220	333	377	-
84	187	235	357	404	-
90	214	269	409	464	-

Continued – Weight tables – Series B

Diameter	Weight-Series B C75	Weight-Series B C100	Weight-Series B C150	Weight-Series B C175	Weight-Series B C250
ID (Inch)	(lb/ft)	(lb/ft)	(lb/ft)	(lb/ft)	(lb/ft)
96	242	306	465	526	-
99	258	324	494	-	-
102	273	344	523	-	-
105	288	363	554	-	-
108	305	384	586	-	-
114	339	427	-	-	-
120	375	472	-	-	-
123	392	495	-	-	-
126	411	519	-	-	-
129	431	543	-	-	-
132	450	568	-	-	-
138	492	620	-	-	-
144	535	675	-	-	-
147	556	702	-	-	-
150	579	732	-	-	-
156	626	789	-	-	-
158	642	810	-	-	-

F. Quality Control

Quality Control testing will include thorough checks of all raw materials against Future Pipe’s strict written standards, parallel plate stiffness testing, loss on ignition testing, wall thickness measurement, Barcol hardness, Glass Transition Temperature (Tg) checks, and complete visual inspection before shipment. Records of all testing on pipe sections will be maintained by Future Pipe Industries.

TYPE OF TEST	EACH PIPE	ONCE PER LOT	STANDARD REFERENCE
Wall thickness	X	-	FPI
Visual Inspection	X	-	FPI
Diameter Spigot End	X	-	FPI
Hydrostatic Pressure*	X	-	FPI
Length	X	-	FPI
Stiffness*	-	X	ASTM D2412
Barcol Hardness	X	-	ASTM D2583
Loss on Ignition (LOI)	-	X	ASTM D2584
Axial Tensile Strength	-	X	ASTM D 638
Hoop Tensile Strength*	-	X	ASTM D 2290
Glass Transition Temperature	-	X	ASTM D 3418

* size limitations apply; please check with FPI.

G. Visual Properties

- The exterior surface of Future Pipe Industries pipes and joints are to be commercially free of the following visual properties:

<u>Visual Property</u>	<u>Definition</u>
Fuzz	Glass fibers loosely adhering to the pipe, which are not wet out with resin.
Protruding Fibers	Glass fibers sticking out from pipe surface that are wet out with resin.
Resin Runs	Runs of resin on surface of pipe
Dry Area	Area in laminate with glass not wet out with resin.
Hand Lay-up	Areas at the end of hand lay-up that are not rolled down properly and that are rough.
Rugged Edges	

H. Repairs

Repairs of the pipe will not exceed 3% of the interior surface and 3% of the exterior surface. Number of repairs will not exceed an average of 1 per 3 ft of length of pipe in each surface.

I. Marking and Identification

Each pipe section shall be marked with the the manufacturers name and:

1. The word **Fiberstrong™- R-P**
2. Nominal Diameter in inches (16" and larger)
3. Product series; A or B (**A**boveground or **B**uried)
4. Pressure Class in psig
5. Inspection mark

Example : FPI Fiberstrong-RP 64" – Series A – C100

J. Packaging

Pipe shall be suitably cradled, wedged or braced to prevent damage during shipment per packaging specification.

K. Handling and Storage

1. Do not stack for storage without prior written approval from Future Pipe Industries.
2. When storing the pipe directly on the ground, be sure that the ground is flat and free of potentially damaging debris.
3. Pipe sections 40 ft or less in length may be lifted using one support point. Any pipe section may be lifted using two support points separated by half of the section length and located equidistant from the pipe section center.
2. Pipe supports for lifting must be pliable straps or ropes and shall not be steel cables or chain unless sufficient padding is used to protect the pipe surface.
5. **DO NOT DROP OR IMPACT THE PIPE, PARTICULARLY AT PIPE ENDS.**
6. **CAUTION:** Workmen should wear gloves when handling pipe to protect hands from rough exterior surface.
7. Additional detailed handling instructions are available from Future Pipe Industries Inc.



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